R YEARBOOK

HOSPITAL TOPICS

1955

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Foreword

It is with a great deal of pleasure that we of HOSPITAL TOPICS present this, the sixth volume of the O.R. Yearbook. As did the previous Yearbooks, this volume brings together in a permanent reference form, the important material published in the O.R. Section during the past year.

Editorial matter presented in the O.R. Section is independently selected and prepared by the HOSPITAL TOPICS' staff. The guidance of Carl W. Walter, M.D., of the surgical staff of Peter Bent Brigham Hospital, Boston, and of Dorothy W. Errera, R.N., is gratefully acknowledged.

Ethicon, Inc. financially sponsors the O.R. Section and each year sends individual gift subscriptions to over six thousand operating room nurses.

Gordon W. Marshall

Publisher

the O R

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New Surgical Technic Explores Deep Recesses of Brain

By Kenneth R. MacDonald

● An elaborate "push-button" operating room has been opened at Mount Zion Hospital, San Francisco, where a recently developed "stereotaxic" technic will be used by surgeons for exploring and treating the deep recesses of the brain.

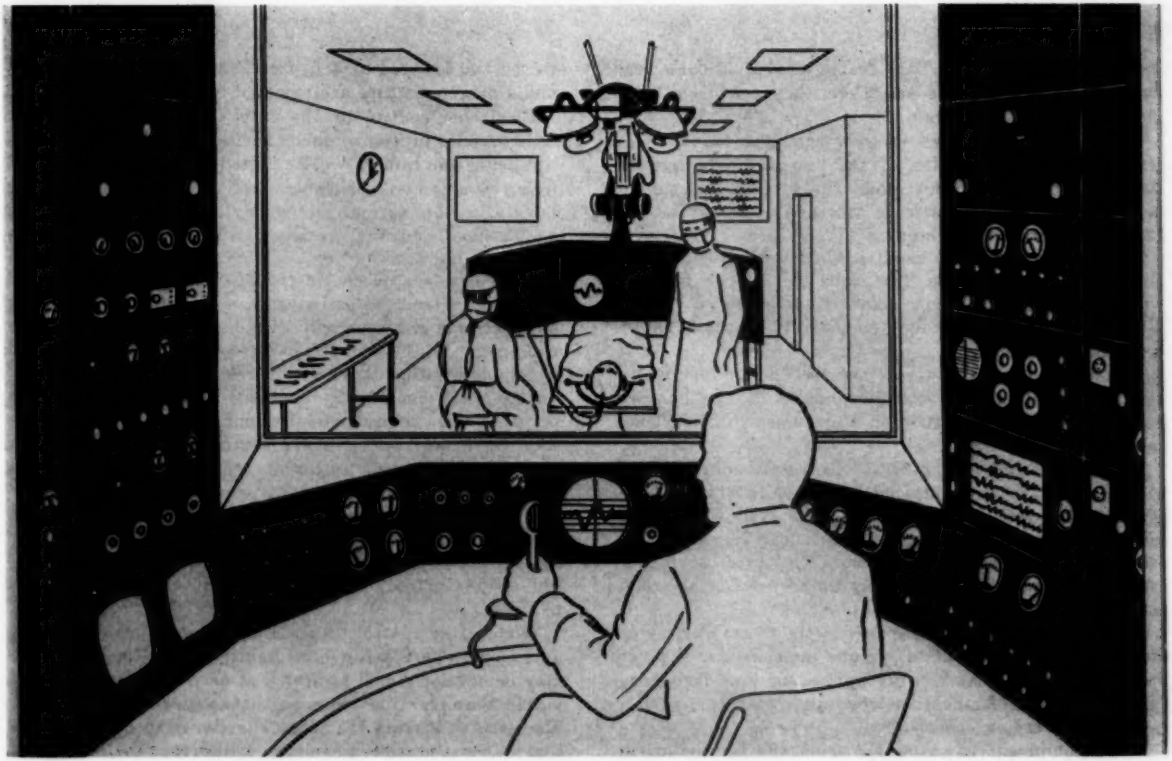
Basis of the new technic, developed largely by Swedish investigators, is an intricate aiming device which, after proper mathematical measurements have been fed into it, permits the surgeon to insert a needle or an electrode deep into the brain with assurance that it will land directly on the desired area.

The procedure, so painless that it can be conducted under local anesthesia, provides a new method for studying and treating some types of cancer, certain psychotic and psychoneurotic conditions, intractable pain, hypertension, cerebral palsy, and nervous and muscular disorders.

A major objective of research, to be conducted at the hospital's Neurological Institute for the Study of Human Physiology, will be the experimental destruction of the pituitary gland as a last-chance procedure for inoperable cancer.

The stereotaxic technic, which permits a surgeon to penetrate the brain recesses within 1/16 of an inch of accuracy, has been used by only a handful of surgeons in this country. By means of the delicate precision instruments, or by very fine x-ray beams, ultrasonic energy or microwaves, specific areas within the brain can be treated without mutilating or destroying the surrounding tissue.

A special headgear is fitted in place on the patient and is adjusted according to measurements made from x-ray photographs of the head. Electrical activity from within the smallest area of the brain can then be recorded. To



Artist's drawing of electronically controlled brain surgery unit at Mount Zion Hospital. The push-button operating room, which provides the new technic for exploring and treating deep recesses of the brain, is the first of its kind in the United States.

locate the exact "target," the frame on the patient's head has a grid. When x-rays are taken, they provide a "grid map" of the patient's brain.

A calibrated headpiece is then attached to the head frame. Using the position of the "target" area against the x-ray grid map as his guide, the surgeon adjusts the headpiece so that an electrode attached to it will hit the exact spot within the brain.

The surgeon makes a small hole in the patient's skull and inserts the electrode. The same technic can be used, with different mechanisms attached, to direct a narrow x-ray beam or other radiant energy. With these no incision is required.

If samples of fluid or tissue are needed, the aiming device can be fitted with a hollow needle. It can be used with a cauterizing electrode or a syringe to inject radioactive chemicals.

The entire operating suite is electrostatically shielded with a copper screen contained in the walls which seal it off from the rest of the hospital. The walls, floor, and ceiling also are completely lined with lead to permit the use of radiant energy without penetration of other rooms. The entire area will be as nearly germ-proof, dust-proof, and explosion-proof as humanly possible.

A movable, sterile control panel in the room will enable the surgeons to manipulate various instruments, such as the electronic stimulator, x-ray apparatus, high-frequency diathermy unit, ultrasonic microwave apparatus, and a variety of recording devices.

X-ray equipment is suspended from the ceiling above the movable operating table by a rail system permitting the heavy unit to be movable in any direction, and to be raised and lowered by a hydraulic system. A therapy unit and a diagnostic tube are mounted in the carriage.

Electronic control of the x-ray tube by photoelectric cells permits precise alignment with the patient's head.

A television camera will be nested in a battery of special lights mounted on a movable carriage above the operating table. Close-up, normal, and wide-view television shots will be possible, and the operation will be televised to the hospital's auditorium.

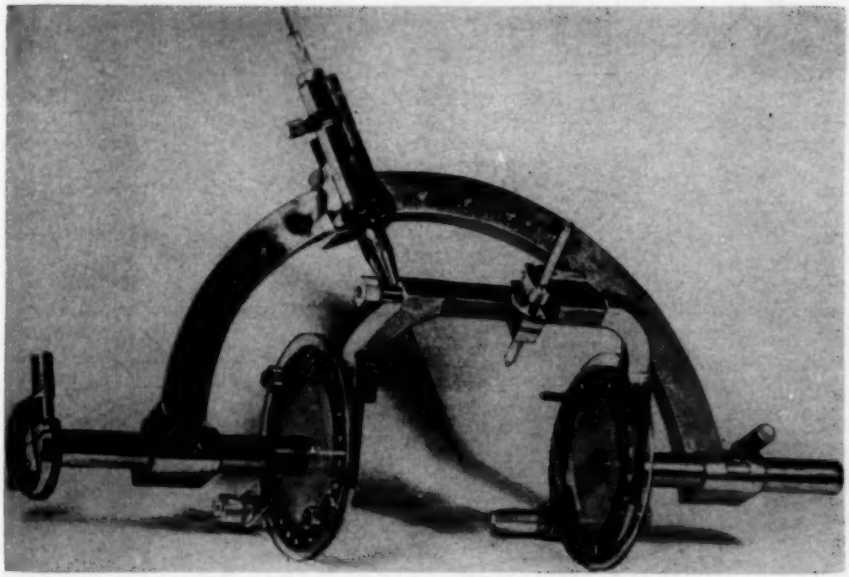
Immediately adjacent to the operating suite, separated from it by a leaded glass window, is a control booth, where an electronic engineer will be able to manipulate all the equipment in the suite from a complete set of control panels duplicating those within the operating room.

The booth includes a complete television monitoring panel and an intercommunication system allowing two-way conversation between the control booth and operating room, the x-ray and projection rooms, and the television viewing auditorium.

When necessary, the surgical team will be able to leave the operating room or retire behind a leaded screen, after the patient is prepared, while radiographic and x-ray procedures are applied from the duplicate panels in the control booth.

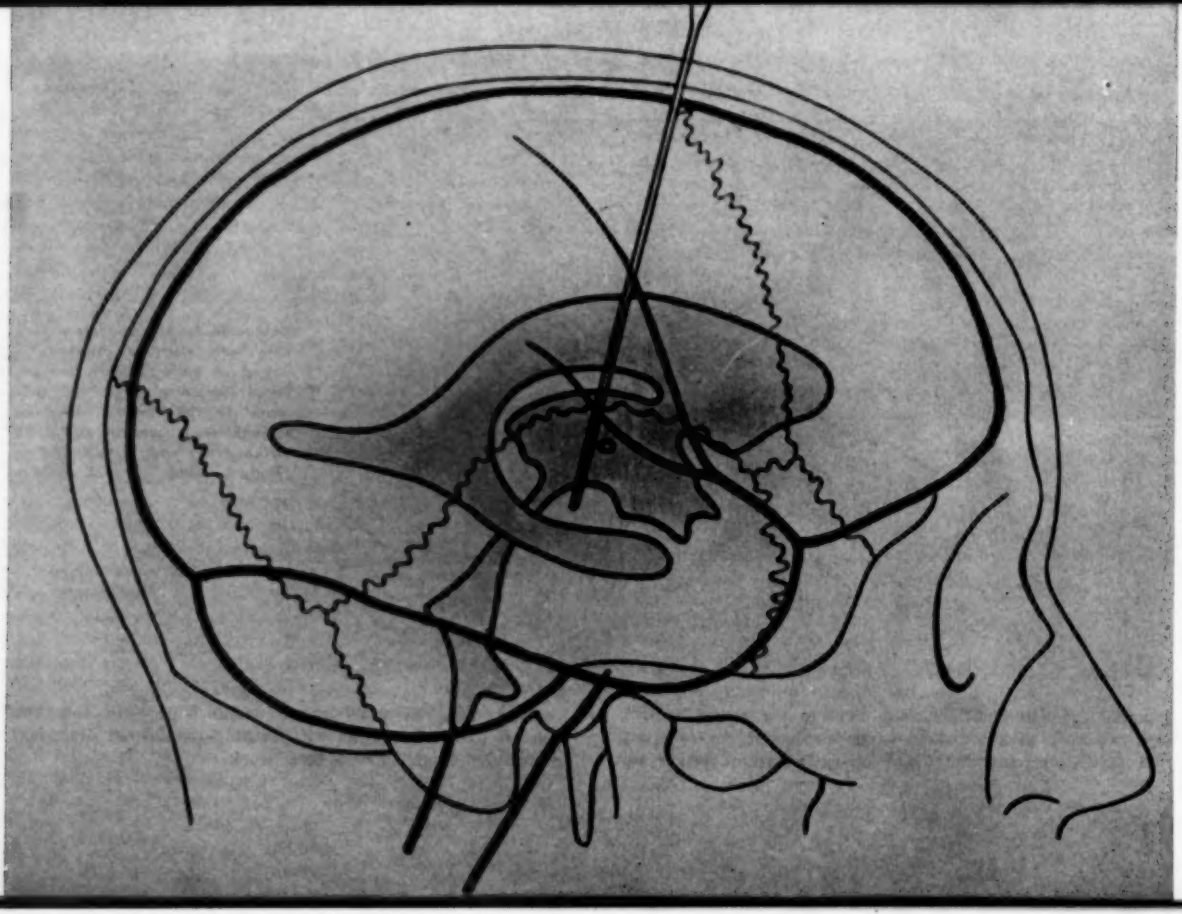
Next to the control booth is a combined projection and darkroom, where x-ray films taken during the procedure may be developed and projected at once onto a wall screen within the operating room, so that surgeons can view the film without leaving the surgical suite. A special lens system makes it possible to enlarge or decrease the size of the image.

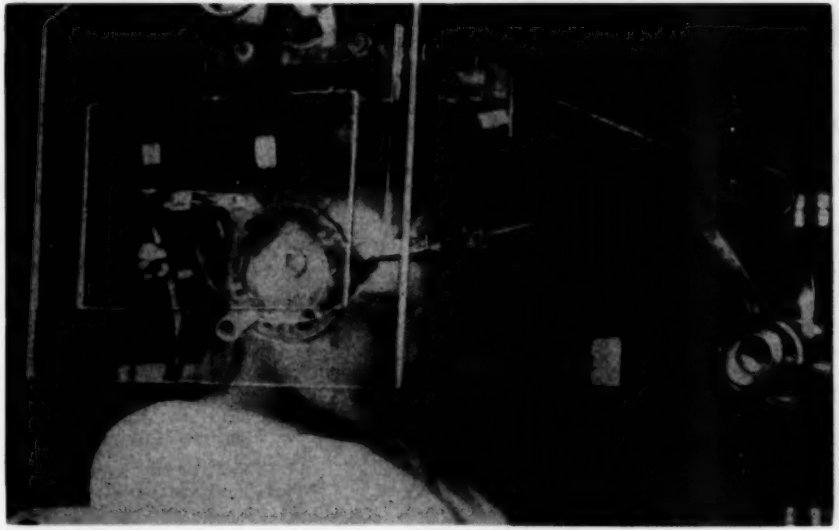
The patient can be "hooked up" to an electroencephalo-



Calibrated movable headpiece (seen here with electrode attached) is placed on patient's head and adjusted according to x-ray "grid map" so that needle, inserted through small hole in skull, will strike exact spot within brain's sphere to within 1/16 of an inch.

graph located in another room next to the control booth, and tracings of his brain waves projected continuously onto a wall screen within the operating room. Other recordings will be made on an oscilloscope built into the control panel. Surgeons will be able to observe electrical recordings from both as they work.





After framework, including grid (seen placed around ears), is placed on patient's head, x-ray films are taken laterally. Films show up entire brain against grid—like a military grid map. Air-filled hollow spaces show up against grid.

Left: Artist's drawing of patient's brain (within heavy black line) with air-filled hollow spaces (grey areas) as they show up on x-ray film. X-ray would show these areas against grid background. Surgeon uses "grid-map" to locate two fixed points, marked "A" and "B"—which are in relatively same position in every human brain—as finders to locate particular "target" within the brain.

Sterilization of Supplies*

Part I-Sterilization by Chemicals

By Velma L. Chandler, Ph.D.**

My first suggestion is that you read the labels when you're considering new chemical sterilizing agents. Don't be misled by what an enthusiastic salesman has to say, or be guided in your purchases by a penny-pinching purchasing agent. Read the labels!

There are federal agencies which control the claims made for all those agents. Read the labels, read the brochures, and then you will know in which situations they can reliably be used.

If you don't understand the bacteriologic data that are presented, go to your bacteriologist. He will be able to help you. Having obtained the information to validate the claims made, you will have a much better basis for a rational use of chemical agents.

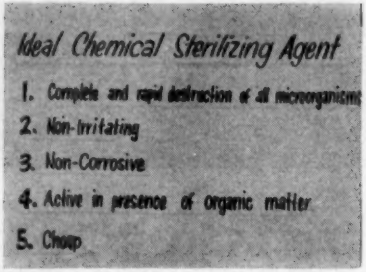

Ideal Chemical Sterilizing Agent
1. Complete and rapid destruction of all microorganisms
2. Non-Irritating
3. Non-Corrosive
4. Active in presence of organic matter
5. Cheap

Figure 1

Although we have many qualms about chemical sterilizing agents, we do realize there are situations in which they must be used. One must recognize their limitations and use them rationally.

An ideal chemical sterilizing agent provides complete and rapid destruction of all micro-organisms, is non-irritating and noncorrosive, is active in the presence of organic matter, and is economical. (See Figure 1.)

*Transcript of discussion presented at Second Annual Conference, A.O.R.N., St. Louis, January 24-27, 1955.

**Dr. Chandler is chief, department of microbiology, Ethicon, Inc., New Brunswick, N. J.

It is also desirable that the agent be nonstaining and that it have either a pleasant odor or no odor.[1]

For the purposes of discussion, I would like to define sterilization as the complete destruction of all microorganisms, and sanitization as a reduction in the number of microorganisms.[2] The terms "germicide," "bactericide," "antiseptic," "disinfectant," and "fungicide" we shall consider as agents which destroy microbial contaminants, *except* bacterial spores and the tubercle bacillus. (See Figure 2.)

[1]It should also be effective against organisms coated with oil, grease, and fat.—ED.

[2]"Sanitization" more generally implies the destruction of vegetative organisms only.—ED.

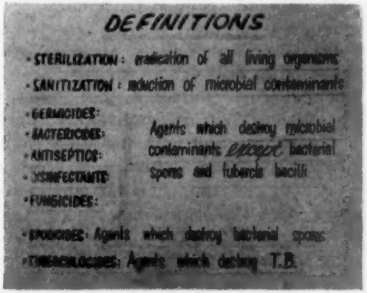

DEFINITIONS
• STERILIZATION: eradication of all living organisms
• SANITIZATION: reduction of microbial contaminants
• GERMICIDES:
• BACTERICIDES:
• ANTISEPTICS:
• DISINFECTANTS:
• FUNGICIDES:
Agents which destroy microbial contaminants except bacterial spores and tubercle bacilli
• SPORICIDES: Agents which destroy bacterial spores
• TBACILLICIDES: Agents which destroy T.B.

Figure 2

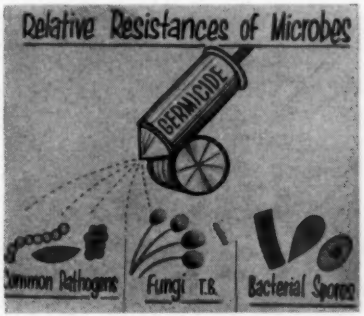


Figure 3

Sporicides are agents which destroy bacterial spores, and tuberculocides are those chemical agents which destroy the tubercle bacillus.

I think that Figure 3 gives a little better idea of what we are fighting with all of these chemical sterilizing agents. The artist has depicted the use of a germicide and the effectiveness of it. On the left are the common pathogens, the non-spore-forming bacteria. They are readily knocked out with almost any of the hundreds of germicidal agents on the market today. If you're trying to combat that single type of organism, almost any agent is effective.

More resistant to germicides are the fungi and the tubercle bacilli.

The highly resistant forms are the bacterial spores. They are shown in the picture contained within the bacterium itself, but the cytoplasm on the outer portion of the bacterium disappears, and the darker center part remains as the spore. As far as resistance to any destructive agent is concerned, there is nothing that is harder to destroy than bacterial spores. They are the most resistant of living forms.

Figure 4

Figure 4 shows you a cross section of a bacterial spore. Chemists have attempted to analyze these spores and to determine why they are so resistant. The only conclusion is that they contain more calcium than do the vegetative forms of the bacteria, but apparently not enough to explain their resistance to chemical agents and heat.

Many of you are interested in agents for use in decontamination of tubercle bacilli. C. Richard Smith, M.D., of the Barlow Sanitarium, published, in *Soap and Sanitary Chemicals*, September-October, 1951, data recommending phenolic soap mixtures. For thermometers he recommends alcohol and mercuric chloride, and for instruments, nonrusting solutions of the phenolic soap mixtures, formaldehyde, and alcohol. (See Figure 5.)

There are differences in the resistance of sensitive cells, average cells, and tough cells, all of which occur in a given population of bacteria, to chemical agents and to heat. We must combat the tough cells. (See Figure 6.)

There are several factors which affect germicidal efficiency, and there must be an optimum balance to effect

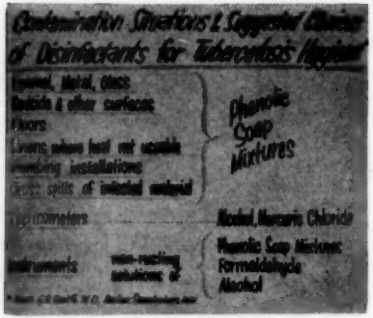


Figure 5

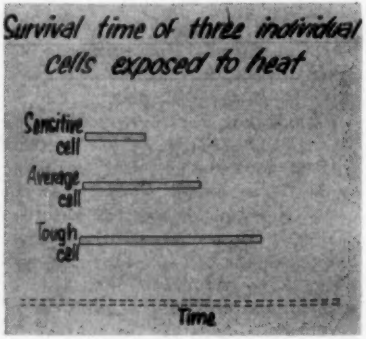


Figure 6

killing as shown in Figure 7. The concentration of the agent must be correct; the temperature of the chemical agent must be considered. Most chemical agents are more effective if the temperature is raised. In actual use, it is seldom practical to elevate the temperature, but even a slight temperature rise will result in more efficiency. Another factor is reaction, or pH, the acidity or alkalinity of the mixture.

A very important factor is exposure time. You will find, if you carefully read the brochures and the labels accompanying these agents, that the manufacturer tells you the required exposure time.

Finally, there must be a minimum amount of organic substance present —that is, blood, pus, or tissue, since the protein combines with the chemical agent, neutralizes it, and reduces its efficiency. (See Figure 8.) This points up the fact that one must have thoroughly clean instruments, syringes, etc., for the chemical agent to work upon the organisms.

Another important reason for ridding instruments of the proteinaceous material prior to sterilization, as I have described, is that organisms are

protected by the protein within crevices and hinges. No chemical agent can destroy bacteria unless there is direct contact. I would like to emphasize the extreme importance of good, thorough mechanical cleansing of glassware and instruments. (See Figure 9.)

Wherever heat can be used, use heat. It is the best sterilizing agent. Don't try to take short-cuts. It's those bacterial spores we have to fight, and we have to pretend they're always with us.

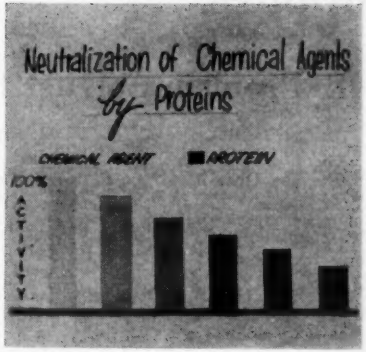


Figure 8

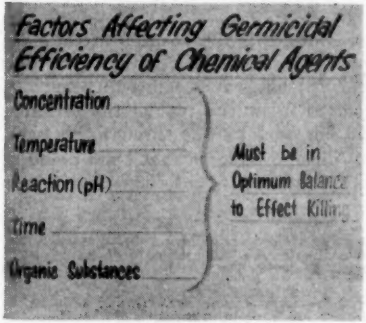


Figure 7

Figure 9

Sterilization of Supplies*

Part II.-Problem-Solving Clinic

MODERATOR: Mrs. Verna Wilson, R.N., Former Operating Room Supervisor, Barnes Hospital, St. Louis

PANEL: Velma L. Chandler, Ph.D., Chief, Department of Microbiology, Ethicon, Inc., New Brunswick, N.J.—"Sterilization by Chemicals"

P. L. Engler, Scanlon-Morris Division, Ohio Chemical and Surgical Equipment Co., Madison, Wis.—"Sterilization by Saturated Steam"

Helen Horvat, R.N., Central Supply Supervisor, John Cochrane VA Hospital, St. Louis—"Sterilization by Dry Heat"

J. N. Masci, Director, Pharmaceutical Research Section, Johnson and Johnson, New Brunswick, N.J.—"Packaging of Supplies"

Q. We have a 60-bed hospital, and the question of sterilization of our packs arises constantly with every new piece of literature published. We include gowns and towels in our major packs, and have been autoclaving them for one hour. Is that too long?

MR. ENGLER: The time of sterilization is going to be governed by the size and arrangement of the pack, because in order to get complete sterilization—and I presume that you're talking about steam sterilization—there must be complete penetration. You must be very careful in packaging and folding gowns and various other materials to allow for penetration by steam. In other words, the pack shouldn't be in excess of 12 x 12 x 20,[1] and should be very carefully made up so that there are not layers of impervious material to restrict the flow of steam through the pack. The steam must get down into the center of the pack.

The other factor to consider is the position of the pack in the sterilizer. The pack should be positioned so that the layers are vertical. In that way steam will penetrate, because the steam comes in at the top as the air goes out at the bottom, and can work its way through this pack.

When loading a sterilizer, I imagine that I am going to sprinkle the load with water and want the water to run down off the pack.

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*Second and concluding part of the transcript of a panel discussion presented at the Second National Conference, Association of Operating Room Nurses, St. Louis, January 24-27, 1955. The first installment appeared in the September issue.

**Accompanying illustrations are from *Aseptic Treatment of Wounds*, by Carl W. Walter, M.D. and are reprinted by permission of the Macmillan Co., publishers.

1. This size allows for easy handling and is one on which studies of heating and penetration times have been done on standardized material.—ED.

MR. MASCI: The questioner did not mention the temperature of sterilization. It's rather difficult to say whether one hour is too long or not long enough without knowing the temperature used, but I assume that she's talking about the customary technic of sterilizing at approximately 250° F. (121° C.)

What Mr. Engler has said is all very true. The actual time of sterilization can be as short as 20 minutes at 250° F. But this time is counted only from the time that the entire sterilizer reaches that temperature, for if the pack is not properly made up and wrapped it may require at least 20-40 minutes to reach sterilizing temperature. (See Figure I** at right.)

Most of you are familiar with the prescribed rules for making up a surgical pack. However, I'll go over a few of the major points, so that at least we will know that we agree on the basis for packing, particularly packing the larger surgical pack.

It is advisable to place towels and compresses and drapes, folded and one on top of another, so that all the layers are in the same direction. That pack should then be placed in the autoclave so that those layers of fabric are vertical, as Mr. Engler mentioned. The reason for that is that the steam will then displace the air gradually as it moves through the autoclave.

The pack must be loosely packed, and wrapped in such a way that the muslin cover will permit steam penetration but will not permit recontamination later.

Even under the best conditions, it is found that a pack of the prescribed size—no greater than 12 x 12 x 20—will require at least 10 or 15 minutes to reach the proper temperature. If one adds 20 or 30 minutes for the sterilization time, one would conclude that under the best conditions the job could be done in 40-45 minutes.[2] So one hour may be a little too long. (See Fig. II, next page).

Q. Do you sterilize suture needles in dry heat, and how do you wrap them? If Vaseline gauze has been sterilized by a hot-air sterilizer for two hours, how long is it considered safe—that is, when it's stored in a covered dish?

2. Studies have shown that a sterilizing period of 30 minutes allows for complete penetration of a load plus 13 minutes for destruction of the least accessible spores in the standard pack.—ED.

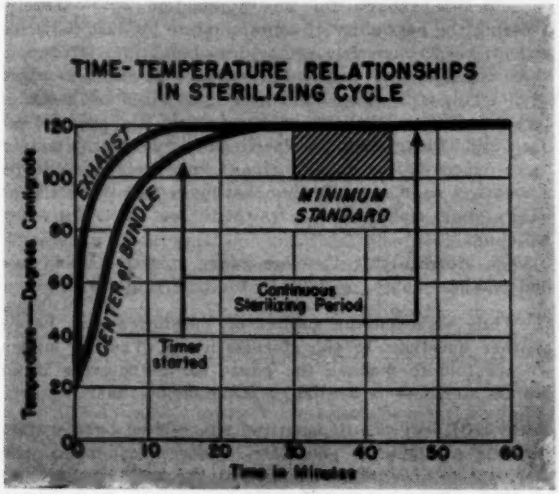

Figure I

MISS HORVAT: We'll start on the first one. Because of the danger of transmission of homologous serum jaundice, all suture needles are sterilized by heat—one hour dry heat at 160° C. (320° F.); four hours at 121° C. (250° F.), or 30 minutes at 250° F. in saturated steam.

In answer to the question about sterilization of Vaseline gauze, sterilization by dry heat is dependent on many factors: the amount to be sterilized, the container's surface and depth, and the temperature used. It is advisable to sterilize Vaseline gauze and ointments in small quantities —preferably enough for one application only—thereby avoiding the possibility of contamination by dust particles and air-borne bacteria, once a larger container is opened.

An effective way to prepare Vaseline gauze is to place 15-20 strips of 2″ roller bandage, 8″ long, in a small catheter tray. These, I believe, measure about 2½″ wide, 1½″ deep, and 8″ long. Melt the Vaseline and add approximately three ounces to the gauze strips. I have found this to be most effective. It is my feeling that more than three ounces of Vaseline makes gauze which is too thick for easy handling.

Then sterilize this Vaseline gauze at 150° C. for two and one-half hours, or 170° C. for half that time.[2]

Q. While we're on the subject of Vaseline gauze, here's another question: In the sterilization of Vaseline gauze we are told to moisten the gauze for autoclaving if no hot-air sterilizer is available. What about that?

MISS HORVAT: To moisten the gauze if no hot-air sterilizer is available is good. Dr. Walter recommends the sterilization of Vaseline gauze with the ordinary dressing sterilizer. You get sufficient steam during the melting process of the Vaseline to provide the moisture that would be required to kill the most resistant spores. Moisture is required to kill the resistant spores, and kills them in less time than it would take with dry heat.

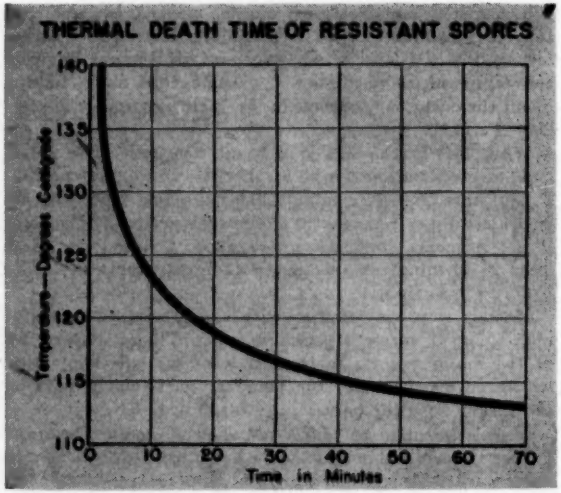

Figure II

Q. Dr. Chandler, what are most hospitals using to sterilize their eye instruments? Sharps, cataract knives, and so forth? How do you sterilize eye instruments, also urology instruments? Do you boil sharps for eye surgery? I think

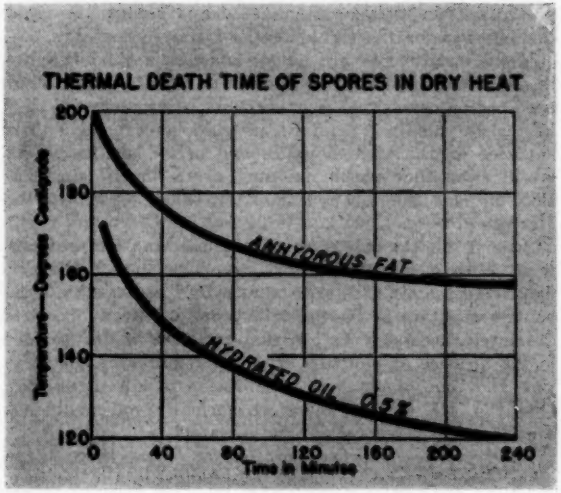

Figure III

you can also include bronchoscopic and GU instruments, because we have questions about them.

DR. CHANDLER: I think it's ridiculous to ask: "What do most hospitals do?" That's not the answer to any problem. What *should* most hospitals do? As I stated before (see pp. 10-13—ED.), any instruments which can be subjected to heat should be sterilized by heat. When they cannot be, and if you feel that they have been contaminated with resistant forms of bacterial spores, you are taking a calculated risk if you use a chemical agent. There are chemical agents that are effective against bacterial spores, providing that the time of exposure is sufficiently long. Formaldehyde solutions are probably the most effective; iodine also is effective.[4]

But if you feel that you want to take the calculated risk, then almost any of the germicides will be effective against the less resistant types.

Q. Mr. Engler, how satisfactory is paper when used in wrapping supplies?

MR. ENGLER: I think it can be very satisfactory. There are a number of concerns marketing paper that is very suitable for packaging. Now that question gets into packaging again, and perhaps Mr. Masci would have some comment. The only concern that I have about packaging by paper is that when those packs are stored for a period of time the paper will become dried up, and there is a tendency or a possibility of the paper's becoming torn. That is just a personal opinion. I'm still of the old school, accustomed to two thicknesses of muslin—not a canvas, no impervious wrapper such as that. But two layers of muslin is very satisfactory. We do know that there are satisfactory paper wrappers available. I received some nice samples of some unusually tough, porous paper that

3. It has been suggested elsewhere in this magazine that Vaseline gauze be prepared as described, hydrated with 2-3 cc. of water, and sterilized at 160° C. (320° F.) for one hour or 121° C. (250° F.) for four hours. —ED.

4. Caution must be taken to rinse thoroughly all residual germicide from the instruments before they are used.—ED.

I'm sure would be very satisfactory. Mr. Masci, do you have anything to add?

Q. As Mr. Masci talks, I think he can give us something on this at the same time: In case the emergencies increase the operations for a day's schedule and you need additional silk sutures or material, can you "flash"-sterilize silk, using the flash instrument steam autoclave? Can you also "flash"-autoclave unwrapped sponges in an emergency?

MR. MASCI: As Mr. Engler has said, there are several papers on the market which are quite suitable for many packaging jobs in preparing materials for sterilization.[5] All of these papers, however, must be used wisely. Even a 35-pound white Kraft becomes quite brittle after sterilization. For that reason it is not advisable to wrap large packs with paper. They're so easily punctured in handling.

Paper is very useful in wrapping syringes and other glassware. Wherever the handling of the item is not a problem, certainly the right kind of paper can be used. However, it must be strong; it must not become excessively brittle on sterilization.

There's another problem. There are many strong Kraft papers on the market which have been highly calendered —that is, run through a roller press at high temperature and pressure while wet. This process forms the paper into a good, tight paper, but unfortunately it's a little too tight. This kind of paper reduces the rate at which steam penetrates quite a bit.

To go into the other question, I think it would be well to consider first just why "flash" sterilization is considered acceptable for metal instruments.

Remember that the prime considerations in killing bacteria by saturated steam are having moisture present at the surface that's contaminated and having the right temperature for the right length of time.

Metal instruments are unique among surgical supplies in that they have only a surface to be sterilized. They need not be penetrated. Furthermore, being of metal, they heat very rapidly. Therefore, instruments can have their surfaces loaded with moisture and arrive at the proper sterilization time within minutes, or in "flash" sterilization, in less than a minute after being placed in the sterilizer.

Such is not the case with silk sutures and gauze dressings. With a gauze dressing you have the problem of displacing the air with the steam before you can condense enough moisture in the fabric to sterilize effectively. It is absolutely necessary to get that moisture there, because in the absence of moisture it would require the temperature and time of dry-heat sterilization to kill the spores. (See Fig. III, p. 17). Therefore normally you would not consider such a technic for these materials.[6]

However, in emergency procedures, when there is no other recourse and a human life hangs in the balance, certainly any step toward minimizing the risk but controlling the emergency may be justified by the surgeon.

Q. Is it necessary to moisten the inside of drains, catheters, tubing, and so forth before autoclaving?

MR. ENGLER: The inner side of the catheters and tubing is always moistened, because the rubber will not allow the

5. Bacteriologic data substantiating the use of these paper wrappers has not been readily available.—ED.

6. Small quantities of silk, unwrapped and hydrated prior to being placed in the sterilizer, can be effectively sterilized in the high-speed sterilizer. —ED.

steam to penetrate from the outside in, and if the tubing does contain moisture that will be flashed into steam when the temperature is raised in the autoclave, you have the effect of saturated steam to accomplish the sterilization.

Q. Please suggest the proper method of keeping Penrose drains sterile in surgery. Miss Horvat, will you answer that?

MISS HORVAT: I would advocate preparing Penrose drains in single containers. I think the more you can fix your containers for just one usage, the better technic you'll carry on throughout. But I would recommend trying to anticipate your needs for a particular day and preparing accordingly, to avoid carry-overs and use of possibly contaminated items.

Q. Anybody else on the panel have any ideas? Probably we'd better let that ride. I know it's done millions of different ways.[7] Now, what method can be used in checking autoclaves for effectiveness in sterilization, other than doing cultures on sterilized packs and using Diack controls?

MR. ENGLER: I consider the use of a potentiometer a good way of checking sterilizer efficiency. A potentiometer is a device in which a thermocouple, which is just a heat-sensitive junction of two wires, is located in the center of a pack or flask. The wires are brought out the sterilizer door, and the time required for the center of the pack to reach sterilizing temperature is either read on a dial or recorded on a temperature chart.

Another possibility is the use of "telltale" thermometers which are located directly in the pack. The temperature, as with an ordinary fever thermometer, will stay at the maximum point reached until the thermometer is shaken down.

Q. Mr. Engler, what do you think of the chemical indicators on the market today?

MR. ENGLER: There are several good indicators on the market. The only thing I'm worried about is the proper use of them. They have to be located right, and they have to be read correctly. Some of these indicators have sections in which color changes. A dozen people will get different ideas of how much of a change took place. So you always have the human element in the use of those indicators. I really wouldn't care to say anything for or against them.

DR. CHANDLER: I would like to know why people are objecting to using bacterial cultures. They are the best indicators. Baltimore Biological Laboratories now supplies a preparation of a heat-resistant, spore-forming organism which can be sterilized with a load and then sent to the laboratory for culture.[8] It's a wonderful indicator for the efficiency of the sterilizer.

MR. MASCI: I want to comment first on what Mr. Engler said. He's quite right about the matter of controls, and so is Dr. Chandler. There are two bases for establishing

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7. Penrose drains can be prepared as any other surgical supply—packaged in muslin wrappers, sterilized at 250° F. for 30 minutes, and stored in a clean, dry, vermin-free place until used.—ED.

8. The use of bacterial cultures for the control of sterilization is impractical because the incubation period is too long. See detailed discussion in Chapter VIII, *Aseptic Treatment of Wounds*.—ED.

good controls for hospital or any other sterilization. One is that by the use of resistant organisms placed in strategic parts of the load under actual operating conditions, you demonstrate that under a given set of conditions you can kill these bacteria.

The second is that a set of mechanical controls is needed to demonstrate that these conditions are maintained or reached every time the autoclave is run. One without the other is not quite complete. And although it may seem redundant for you to have each hospital check its sterilizers, it is a fact that the actual conditions of making a pack and running a sterilizer vary so that it is indeed worthwhile to check the conditions of sterilization with bacterial cultures. The other controls are mechanical and insure the proper functioning of the sterilizer. By the proper use of bacterial cultures, you can gain assurance of the reliability of the thermometer, the recording thermometers in the exhaust line, and the pressure gauges.

Q. If the most heat-resistant spores are destroyed in 13 minutes' exposure to saturated steam at 250° F., why do you recommend 20-30 minutes after the pack is entirely heated throughout?

MR. MASCI: The only reason is to provide a margin of safety. When I say to start timing after the pack is entirely heated throughout, we must recognize that not all the packs are going to reach temperature at exactly the same time, and some provision must be made for those packs which contain either denser materials or are more densely packed. It is just the margin for error.

Q. Dr. Chandler, where do you obtain the spore indicators?

DR. CHANDLER: Baltimore Biological Laboratories, Baltimore, Md.

Q. Dr. Chandler, is Zephiran solution safe to sterilize sharps, needles, and instruments? How long is the sterilization time?

DR. CHANDLER: Zephiran is one of the quaternary ammonium compounds, of which there are thousands. They are not sporicidal. I have no concrete evidence that they are tuberculocidal either. They do kill off common bacterial pathogens, and they will attack the molds and the fungi.

Knowing those limitations, you have to decide whether you want to take the calculated risk that I mentioned before, and use them in a given situation. One word of warning, however: The time of exposure is extremely important. Sterilization does not occur immediately with the more resistant type of organism; it does occur rather readily with the less resistant types. So you must use sense and reason when you employ these agents, and recognize their limitations. If you look at the labels for any of the "quats," you'll find there is no claim for sporicidal activity. Are you willing to use them in situations in which the manufacturer does not recommend their use? If you must use them, employ the correct exposure time and the correct concentration, and be sure you have removed all organic material.[9]

Q. Please discuss boiling of instruments.

MR. MASCI: Certainly today boiling instruments is con-

9. Chemical disinfection of instruments and needles should be abandoned in favor of heat sterilization because of the danger of transmission of homologous serum jaundice.—ED.

sidered a second choice. Steam sterilization performs so effectively and so much more rapidly that certainly every hospital can afford one steam autoclave.

If there is no other alternative, then there are a number of precautions which should be adopted to make boiling water sterilization of instruments more effective. One thing to remember is that boiling water will kill all but a few very resistant spores in about 30 minutes of free boiling at 212° F. In the higher altitudes in the West and the Midwest, one runs into the problem of a lower boiling point of water, and in places like Denver, water may boil at a mere 200° F., I am informed.

That fact poses a very considerable problem and should be reason enough for not considering boiling-water sterilization of instruments at all. Under those conditions, at 200° F., it would require at least 60-70 minutes to reproduce the same condition obtained at 212° F. in 30 minutes.

With those few words, I would say, prepare the instruments very carefully for boiling-water sterilization by cleaning them thoroughly of all organic matter, grease, and oil. Be sure that they are completely submerged in the sterilizer. The addition of alkali to lower the hydrogen ion concentration is desirable, inasmuch as the time for sanitizing can be reduced from 30 minutes to 15. Sal soda is added to the sterilizer to make a two percent solution or lye to make a 0.1 percent solution.

Q. Miss Horvat, how can we prevent the charring of materials in a hot-air oven?

MISS HORVAT: Cotton material will char at 200° C., and the important thing to remember when sterilizing anything with cotton or gauze stoppers is to maintain the temperature at 160° C. for two hours and not allow it to go any higher.

Q. What would you say is the best way to treat materials used in a contaminated case? Pathogenic organisms, such as the tubercle bacillus?

DR. CHANDLER: Linens, instruments, and other material contaminated with the tubercle bacillus should be autoclaved. Floors, pans, etc., are best disinfected with the various phenolic soap mixtures.

As far as linens are concerned, they should be autoclaved, even before they're laundered.[10] As a matter of fact, autoclave everything possible. That's the safest way to destroy organisms.

Instruments which cannot be subjected to heat and which are contaminated with tubercle bacilli may be sterilized by exposure to Chlorpactin, which, I am told by the Trudeau Laboratory (the National Tuberculosis Association laboratory), is very effective as a tuberculocide. This laboratory has recommended it for use with bronchoscopes, saying it will not destroy the cement. If tetanus, gas bacilli, etc., are the contaminants, you *must* use heat.

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10. Linen from a contaminated case can be safely handled without autoclaving if the following technic is observed: The soiled linen must not be allowed to dry for prolonged periods of time. The contaminated linen and the bag in which it is contained are dumped into a washing machine, which is filled with cold water and run for 20 minutes to take out blood stains and leach out the proteins. Water softener and soap are then added until there is a good head of lather. Three percent excess soap is next added to provide a minimum pH of 11 to insure sterilization. The water is heated to boiling, and soap is added a second time to make a good head of lather. The clothes are then rinsed and finished along with the other hospital laundry.—ED.

You can't take the chance of disseminating those things throughout your surgery.

MR. ENGLER: I'd like to take this opportunity to bring in the question of sterilization of contaminated instruments, which Dr. Chandler mentioned. There is available the instrument washer-sterilizer, which is especially designed to take care of instruments which have been contaminated, without danger to the person handling them.

Q. If you have more instruments on an instrument tray, do you autoclave it longer than you do a small load?

MR. ENGLER: We always time sterilization by reading the thermometer which is located in the air and condensate discharge line, which is the coldest part of the sterilizer. Start timing the sterilizing cycle when that thermometer gets up to 250° F., or, if you're using high-pressure sterilization of instruments, 270° F.

Q. Mr. Engler, would you go ahead and give the sterilization time on linens, hardware, glass, rubber goods, and so forth, from the time you start timing?

MR. ENGLER: On linens, in properly loaded sterilizers, packaged as discussed previously—30 minutes at 250° F. On hardware, 15 minutes, at 250° F.

Q. Unwrapped or wrapped?

MR. ENGLER: That's unwrapped instruments and hardware.

Q. How about glass, unwrapped?

MR. ENGLER: If it's placed in the autoclave in the proper manner, in such a way that air can escape freely from the container, 15 minutes at 250° F.

Q. How long for rubber goods—the same?

MR. ENGLER: Rubber goods—15 minutes at 250° F.

Q. If instruments are wrapped, how long?

MR. ENGLER: Minimum of 15 minutes.

Q. Miss Horvat, do you agree with these?

MISS HORVAT: I don't think anyone will ever agree. I think everyone has pretty much her own system on timing.[11]

Q. How long can muslin-wrapped packages be considered sterile if they are stored?

MISS HORVAT: I'm afraid to say again, because I'm sure there will be wide discrepancy of opinion, and there are too many factors involved to permit me to give a blanket opinion.

MR. MASCI: Since I'm not an operating room supervisor, I can speak a little more freely, because I don't have to face a lot of angry people afterward. Generally, it is conceded that dry goods shouldn't be stored more than two weeks. The problem is very difficult, however, because it involves whether or not the packages have been so wrapped as to control the bacteria that might re-enter the package from breathing, due either to handling or atmospheric changes. For that reason it is very difficult to say whether a package is going to last three weeks, three months, or three years. Conceivably, it can do any of those.

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11. What is the time required to destroy bacteria? Do not forget this common factor in the problem.—ED.

As a safety precaution, just in case the wrapping is not quite the best, certainly a two-week period seems reasonable.

Q. What material do you recommend for cloth covers, and why?

MR. MASCI: For dry goods supplies, for covers on instrument trays, and similar uses, we recommend two thicknesses of muslin—muslin, because tighter fabrics interfere with the displacement of air by steam, and because it seems fine enough, particularly with two layers, to prevent recontamination through the fabric for an appreciable length of time. That doesn't mean that a pack has to be wrapped with two pieces of muslin. If the wrapping is wide enough so that there are at least two thicknesses at any one spot, it will be adequate.

Q. How many minutes do you recommend sterilizing large metal drums packed with linen?

MR. MASCI: I could hedge that and say it depends on how large the drum is. But you already know that! I can't answer, because it depends entirely on how the drums are packed, what kind of drums they are, and half a dozen other factors which I can't even guess at. However, I think I can indicate what things are important, so that perhaps you can decide for yourself.

On older-type drums which had one or two rows of holes concentrically, the length of time required to get the load up to temperature was astonishing. With the modern drums that are pretty well fenestrated, the delay is not quite so great. However, there may be as much as a 50 percent decrease in the rate at which you can displace the air.

Because all these things are variables, I believe that the only way you can get a satisfactory answer to this is to work out a technic with your own drums and your own sterilizer, using cultures to establish what length of time is satisfactory, and then stick to that routine.

Q. If no hot-air oven is available, what would you suggest for dry-heat sterilization?

MISS HORVAT: I would recommend the use of the ordinary dressing sterilizer. The technic for using it for dry-heat sterilization is as follows: Load the sterilizer as usual; close the door and turn the steam into the jacket *only*. The chamber will heat by radiation. The exposure time is four hours at 250° F. A convenient technic is to load the sterilizer as described and leave the load in overnight.

Q. What agent or disinfectant do you recommend for use in a TB hospital? What chemicals are recommended to disinfect rubber goods used on known tuberculosis cases —example, anesthesia equipment, intertracheal tubes, and so forth? How do you sterilize bronchoscopy instruments? Do you think all bronchoscopy cases should be considered potential TB cases and treated accordingly?

DR. CHANDLER: Chlorpactin, which I mentioned earlier, is obtained from the Guardian Chemical Co., 10 43rd Ave., Long Island City, N.Y. When I knew that I was going to be on this panel, I corresponded with the Trudeau Laboratory, which recommended this agent. I also corresponded with Dr. Smith at Barlow Sanitarium, who has been considered an authority in the tuberculosis field for many years. He still feels that alcohol is a good antitubercular

agent and continues to recommend its use. He also states that one of the phenolic soap compounds, orthophenylphenol, is an excellent agent. "It has recently been shown," according to Dr. Smith, "that the alcohol-formaldehyde mixtures are not as efficient tuberculocides as they used to be considered to be. They're not completely condemned, but they don't stand up there where they used to." Now here's a question that follows that statement:

What type of alcohol and percentage is used for the control of tubercle bacilli?

Dr. Philip Price, at the University of Utah, has done the most work in the study of bacteriostatic and bactericidal actions of alcohol. I don't recall that he ever specified any particular concentrations to be used against the tubercle bacillus, but as a general germicide, he says that any concentration between 50 percent and 90 percent is effective. Most institutions I know use 70 percent, because early work showed that apparently that was the most effective concentration. However, Dr. Price has done much work and has shown that anywhere from 50 to 90 percent is satisfactory.

I'd like to remind you again that it need not be ethyl alcohol. Isopropyl alcohol is just as effective, at 50 to 90 percent concentration. There's of course a distinct advantage to using isopropyl alcohol—the Revenue boys don't have to be contacted on it, and it's a lot cheaper.

Q. How do you sterilize syringes used in infectious hepatitis?

DR. CHANDLER: Sufficient heat will do the job. You realize that hepatitis is caused by a virus which cannot be demonstrated in animals and cannot be cultured. The only way you know whether it exists or not is when it shows up in man. And we can't be running around using people for guinea pigs to find out whether we've destroyed the agent or not.

There is no evidence that the virus has been transmitted when sufficient heat sterilization has been used.

One should be very careful of needles, to use heat sterilization after they've been used on one patient and before they are handled by workers, to prevent transmission of infectious hepatitis from patient to patient.

Blood lancets, employed by technicians, also can carry the infectious agent.

Q. In sterilizing goods—drains and so forth—in boats, are they sterilized with lids on or off?

MISS HORVAT: When sterilizing shallow boats, leave the lids off. Whenever sterilizing any container, take off the lid, because air trapped in the can is a poor conductor of heat. Also the lids should be off all bottles when they are being sterilized.

Q. Can syringes be sterilized by leaving the plunger and barrel assembled and covering the tip with a plastic cover?

MISS HORVAT: I have not become too acquainted with this method, but according to the literature available syringes can be sterilized unwrapped, with just the plastic tip.

Q. What would you consider the best agent for sterilizing heart catheters?

MISS HORVAT: Heat would be the best. It depends on the type, whether plastic or something else.

Q. How soon can gloves be worn after being sterilized?

MR. ENGLER: Sterilized by steam sterilization, I presume—as soon as they cool off.[12]

Q. How can I prevent rubber gloves from becoming tacky in autoclaving?[13]

MR. ENGLER: One thing I would like to say about the question of sterilization of rubber gloves has to do with the proper packaging of rubber gloves for steam sterilization. Rubber gloves should be washed, dried, and powdered, and then in order to get the steam into the interior of the rubber glove it is necessary to keep the glove surfaces separated. A gauze pack is positioned in the glove to provide free access for steam.

If you will do that, and if you'll put the gloves in the specially designed folders, with the thumbs up, so that the air can flow out naturally, you'll find that you get very effective sterilization of the rubber glove at a time and temperature that will not damage the gloves. I think that most gloves which become tacky have been subjected to too high a temperature for too long a period of time, and also have been subjected to too many sterilizations and have almost served their useful life.

Q. How long should nylon scrub brushes be autoclaved?

MR. ENGLER: I would say 10-15 minutes.

Q. How do we have superheated steam, and why do we have it in the autoclave?

MR. ENGLER: That's quite a question to answer briefly. There is a possibility of having a certain degree of superheated steam. If I were to go into the physics of it, it would take quite some time, but I'll say this: The only time that you will have superheating effect is if you put the dressings in the autoclave and leave them in there without any steam in the chamber until they become very desiccated—free of moisture, entirely dry. Then at the time you first admit steam into the chamber you will have such a rapid absorption of the steam by these desiccated fibers that you would be able to measure with a very sensitive thermocouple and potentiometer a little flash of temperature in excess of what you'd normally get at, say, 20 pounds steam pressure in the jacket or 260° F.

Freshly laundered wrappings have enough moisture so that this superheating effect is avoided.

Q. What about sterilization of syringes? Should one end or both ends be closed? Should they be sterilized in open pans, or with the barrel in, or the barrel out?

MISS HORVAT: I think that here, as in other things, there is a wide discrepancy of ideas, but ordinarily it's recommended that the barrel and plunger can be put together and sterilized in syringe boxes, providing they are moistened before they are placed in the boxes. By following this procedure, one is assured of satisfactory sterilization.

For sterilizing syringes in sterile tubes, the same procedure is used—barrel and plunger are put together, and the syringe is moistened before placing in the tube. I think the best way is to separate them to get effective sterilization.

12. Rubber gloves imbibe water during sterilization and should be allowed to dry out for 48 hours after sterilization to regain their tensile strength.

13. Tackiness in rubber gloves can be attributed to many things. All traces of quaternary ammonium compounds should be rinsed off immediately after the gloves are removed. Avoid contact with grease and oil. A small quantity of Bio-Sorb in the rinse water when the gloves are being processed will do much to eliminate the tackiness. Avoid strong detergents when washing rubber gloves; a mild soap should be used.

Q. Is it possible to sterilize wooden blocks for shaping bone grafts? If so, how? The questioner means a square of wood that is to be used to cut bone or cartilage right in the sterile operation.

MISS HORVAT: I would probably wet the block, wrap it in muslin, and sterilize it at 250° F. for 30 minutes.
MR. MASCI: I should think the best way to handle the little wooden blocks would be to autoclave them. They carry enough moisture within them so that autoclaving at 250° F. for 30 or 40 minutes should be adequate.

Q. If Chlorpactin is so effective for tubercle bacilli, would you advise using this for chemical sterilization wherever such sterilization is indicated?

DR. CHANDLER: I have not investigated the activity of this agent. It was recommended by the Trudeau Laboratory, as I reported. However, knowing that it is an effective tuberculocidal agent, I'm sure that it could be used for the eradication of the common pathogens, the less resistant types of bacteria. I don't have any idea about its activity as a sporacide.

Q. Do you think all bronchoscopy cases should be considered potential TB cases and treated accordingly?

DR. CHANDLER: I haven't any idea of the incidence of TB among those cases. I think your physician should be able to guide you in that respect.

Q. What do you think of a formaldehyde cabinet?

DR. CHANDLER: Formaldehyde gas requires, for sufficient sterilization, a long exposure time, and I think that the cabinets do not provide proper conditions.

Q. Do you feel that cold sterilization of knives and scissors is safe and sufficient?

DR. CHANDLER: No!

Q. How long must one sterilize sharps, having steam only in the jacket of the steam autoclave?

MR. ENGLER: I assume that the questioner means that there's going to be only jacket pressure—no steam in the chamber. Then, if you have 20 pounds steam pressure in the jacket, and all air eliminated—no air-steam mixture—you would have the equivalent of 260° F. Under those conditions with no steam you would have a dry-heat or a hot-air oven. I would not like to depend on sterilization by dry heat at 260° F.; 320° F. has been recognized as the temperature required for killing the spores and bacteria under dry heat.

Question Box

Each month questions pertaining to O. R. problems and technics will be answered by Dr. Carl W. Walter, nationally known for his operating room technic courses and as the author of "Aseptic Treatment of Wounds" (MacMillan). Questions should be addressed care of the O. R. Editor, Hospital Topics.

***Q.** I wish to pose two questions: (1) What difference, if any, exists between the Bard-Parker Formaldehyde Germicide and the suture solution put out by Ethicon in their suture cans? I am looking for a solution for the sterilization of knife blades, needles, and scissors. (2) Where can I get further information about O-Syl and its use?*

A. Bard-Parker Formaldehyde Germicide and the Ethicon suture solution are corrosion-inhibited alcoholic solutions of formaldehyde. Bard-Parker Improved Germicide has hexachlorophene (G-11) added to enhance its germicidal properties. The former two require 30 minutes to destroy vegetative organisms; 18 hours to destroy spores. The latter is reported to be effective in 3 hours.

Further information about O-Syl is available from Lehn and Fink, Bloomfield, New Jersey.

***Q.** I would appreciate any information you may have on the correct procedure for the care of rectal gloves, before and after use. I am specifically interested in knowing whether it is necessary to sterilize rectal gloves.*

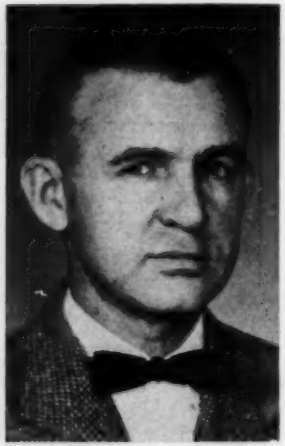
A. Rubber gloves used for rectal and vaginal examinations should be rinsed while on the hand, immediately after use. They are then either washed in an automatic washing machine in which the temperature of the water is raised to 110° F.; sanitized by boiling for 15 minutes; or terminally sterilized in a steam sterilizer. They are then ready for processing and reuse.

***Q.** Is it safe to use closed hemostats which have been autoclaved in two double thicknesses of muslin at 250° for 30 minutes?*

A. Instruments will not be sterilized if the steam sterilizer is locked. Steam sterilization is dependent upon contact of all surfaces with moist heat, and this is not accomplished if there are tightly apposed surfaces.

Explosion Hazards in the Operating Room

By Richard H. Barrett, M.D.



The author is an anesthesiologist at the Hitchcock Clinic, Hanover, N. H. His paper was originally presented before an instructional conference at the New England Hospital Assembly.

● I have been present at one explosion and two fires that have taken place in the operating room. These occurred either during or before my internship. Why I should have elected to go into anesthesiology after these experiences, I have never quite decided.

The explosion and the two fires were the result of a fairly well-established fact—that is, that ether will burn if ignited, or even explode, if given a little support with oxygen. It's as simple as that. It was then, it is today, and it will be tomorrow. Most fires and explosions don't "just happen." People cause them, either directly or indirectly.

I have heard it said: "Why get all excited about the possibility of an explosion or a fire? How often does it happen, anyway, in the operating room?"

The answer to this is rather obvious: It happens usually only *once* to you or to some patient, and that is just once too often. Some of us have been lucky.

Let me quote from a letter received from an operating room supervisor who used to be in our hospital and

is now employed in a large midwestern university hospital:

"I'm still shaking from the experience we had at work today. The thing that every O.R. dreads happened. A gas machine exploded. I was circulating in one room and had just gone to look out the window because it had started to snow when we heard this terrific blast. Couldn't imagine what it was until someone started to scream—so then I took off to find out what was going on. It was in the room across from mine, and I didn't quite know what we would find in the room.

"Luckily no one was killed, but the anesthetist has second-degree burns on her arms and legs and lost quite a bit of hair. The explosion was in the gas bag itself, but I don't think any of the flames went into the patient's lungs. They did a bronchoscopy on him soon after, but his trauma they think was caused from the pressure in the tubes rather than any flames. He has a lot of pulmonary edema, so they left the IT tube in and kept him asleep with a Pento drip.

"This all happened about 8:30 this morning, and he was still in the O.R. when we came off this p.m.

"B. J. was circulating for the case, and I guess it just about scared her to death. She was right near the machine, and it was about three hours before her hearing came back. Guess she and the rest who were in the room all will have hearing tests within the next week. That explosion was something I never hoped to hear or see, but now that I have, I hope never to see another one. We don't know the cause, but it will probably be blamed on cautery with GOE.

"I think everyone has learned a lesson from the experience, though. The patient is a bigwig lawyer, so it will be interesting to find out how this will all turn out. What a day! I thought for a while everyone was 'sent for.'"[1]

This girl now knows what I have been talking about for the past 10 or 15 years. Actually, this type of accident happens once in approximately every 80,000 to 100,000 anesthesias.[2]

Why did this accident happen? The surgeon used an electric cautery in the mouth while the patient was receiving a flammable anesthetic.

How is the patient doing? Fortunately, all right. He happened to be breathing out at the time. There was, however, a 50-50 chance that he might have been breathing in.

I cannot possibly describe in detail all of the potential dangers to be encountered in an operating room, and I refer specifically to those hazards and dangers quite aside from any inherent in certain types of surgery, poorly administered anesthesia, or the possibility of wound infection.

Anything I may tell you is something we all have heard before. It is like telling children to "shut the door" when coming into the house in subzero weather. It is not that they haven't been told before. We are all guilty of being "children" at times, but the present subject is of life-or-death importance.

I frequently tell our nurses and other hospital personnel that I don't care if there are shavings and mud —nice, wet mud—on the floors in the operating room,

but make sure that the side walls and ceilings are clean. We in anesthesia must learn to live in the horizontal—and I don't mean lying down—but we must see things as the patient sees them, and that is usually from the horizontal or supine position. Of course, cleanliness in our operating rooms is of paramount importance, but I trust you understand what I mean.

STATIC ELECTRICITY

You notice I say "nice, wet mud." This brings us to the conductivity of electricity in the operating room. Generally speaking, the type of electricity we fear most is that known as static electricity.

Static electricity is electricity at rest. This form of electricity is the cause of a high percentage of explosions in hospitals. It is usually produced on nonconductors, but it can be transferred and retained on insulated conductors.

Friction between dissimilar, nonconductive materials produces static charges. Some examples of this are the shuffling of feet across a rug on a cold, dry day, running a comb through the hair, rubbing a glass rod with silk or synthetic fabric, and separating blankets or unfolding them. Static charges can be generated by frictional contact and separation of woolen garments, upholstered furniture, and so forth. Did you ever slide out of your automobile on a cold winter's day and be assisted in your departure by a sharp jab behind you as your feet neared the ground? I have seen people look for a pin in the cushion on such occasions. *That* is static electricity asserting itself.

Most materials permit electricity to pass through them, but some materials are such poor conductors that they are considered insulators. Metals and carbon are good conductors, whereas acids, salt solutions, plants, and animals are relatively poor conductors. Various oils, dry wood, silk, rubber, plastics, glass, and air are considered insulators.

Development of electrostatic charges in the average room is impossible to prevent. There is so much activity that frequently frictional contact occurs with one or another of the many nonconductive materials that are present in the room, and charges are thus generated.

The only way to prevent the accumulation of static charges thus produced is to provide paths by which the electrostatic charges may flow away as fast as they are generated. This can be done through the use of conductive floors and efficient conductive contact thereto. All movable conductive objects and personnel present in a room in which flammable anesthetic agents are administered should have proper electrical contact with the floors.

To put it even more plainly, static electricity is that form of electricity which one sees, or hears, when one strokes a cat's fur.

Incidentally, a short while ago a graduate fellow in physical science figured out how many strokes of a cat's back it would take to light a 50-watt electric light bulb for one hour. The figure was approximately 1,763,550,625 strokes. The danger of electrocution from this indoor pastime is not to be feared—but the amount of electricity generated by just one or two strokes of

a cat is sufficient to cause a death-dealing explosion under proper circumstances—also, I suppose it might depend on the kind of cat!

It is true that we do not have cats (in the true sense of the word) in operating rooms; however, there are some operating rooms that I have visited in which their presence would not seem at all out-of-place.

Although it would be a little far-fetched to imagine seeing cat fur in the operating room, we do see other items which are just as capable of producing static electricity, such as lamb's wool, nonconductive gum-rubber-soled shoes, dry leather-soled shoes, wool blankets, rayon and nylon uniforms and stockings, or shark-skin uniforms, cotton blankets now containing nylon or rayon, nonconductive rubber-covered pads on operating tables and anesthetists' stools, and several other things equally out-of-place in the modern operating room.

Some nurses rebel at wearing unironed, or even ironed, cotton scrub dresses, and cotton stockings seem to be especially taboo among nursing personnel. Actually, it would be much safer for all concerned, at least from the explosion standpoint, if *all* O.R. personnel wore *no* stockings *at all.* They are not worn out-of-doors. Why put them on in the operating room? At one time it was decreed that nothing but cotton clothing throughout should be worn in the O.R., but now it is accepted fairly generally that nylon or other synthetic undergarments may be worn if the whole garment is in contact with the skin. The bodice of a slip qualifies; the free-hanging skirt is hazardous.

Schiaparelli, Claire McCardell, Dior, and other designers have not, as yet, invaded the panorama of the operating room, and it is doubtful that they ever will. Glamor is out-of-place in the O.R.—the moving-picture industry to the contrary. There is another much more important reason for the existence of this room which is found in nearly every hospital. Remember? It is a place in which patients receive the best surgery available in the safest possible manner.

Please do not think for a minute that I am blaming or pointing my finger at the permanent operating room personnel, for I am well aware of the fact that many surgeons are directly responsible for hazardous conditions which exist in some operating rooms, and the anesthesiologists are equally responsible for letting them get away with it.

In those hospitals in which there is no anesthesiologist, it is the responsibility of the physician anesthetist or the anesthesia nurse to be on guard against hazardous conditions that might result in fires or explosions. This may not put these persons in a position to make friends, but they can influence people, and any idea of taking part in a popularity contest should be discarded. Next to the patient, the person who administers anesthesia holds the most dangerous position in the operating room. He or she is the guardian of the welfare of *everyone* who *is* in or *who may enter* this room. If for no reason other than the very selfish one, he should be governed by that basic instinct of self-preservation.

Internists, pathologists, medical students, and others have a way of drifting into operating rooms to observe unusual, or usual, operations or pathological specimens. These persons simply do not know the potential danger

which is created for themselves and for those about them by these occasional visits. They must be told! An internist wearing wool trousers and other nonacceptable attire—even if he is the chief of staff—who enters the operating room during the administration of flammable anesthetics may serve as an A-1 detonator. He must be told in proper but certain terms that in this condition he is a menace. Diplomacy should, of course, be used at all times, but if this is unsuccessful, you are fully justified to use any readily understandable language—even operating room dialect if necessary.

Under most circumstances there will be no difficulty with these wandering creators of static electricity, but in even the best-known and best-run institutions there are apt to be a few prima donnas who will bear watching and warning. Remember it is your life and that of the patient that may be at stake, and act accordingly.

Conductive casters and conductive-soled shoes are useful for removing static electricity from operating room equipment and personnel, respectively, only if the floor is definitely conductive. I have visited institutions in which all the "rolling stock"—that is, tables, stands, intravenous poles, etc.—had conductive rubber casters and also properly adjusted drag chains—but on a completely nonconductive floor! There might have been some excuse for this if there had been even contemplation of the installation of the conductive floor, but such was not the case.

In contradistinction to this situation, I visited a hospital not long ago in which the operating team, operating table and other furniture, including the anesthesia equipment, and the anesthesia personnel all stood on a solid steel plate which in turn was attached to a steam pipe! All I could think of was what would happen if there were a short circuit in the operating light above the table and someone standing on this plate—which was kept moist—should reach up to adjust the light. Fricassee of O.R. personnel! Why it is that some people try so hard just to really get into trouble?

Much effort has been expended in trying to find an acceptable operating room floor. I would like to tell you what George J. Thomas, M.D., of the St. Francis Hospital, Pittsburgh, has to say on this and some other subjects.[3] Dr. Thomas has had wide experience in preventing operating room hazards and fortunately has been in a position to be in close association with the Mine Safety group in and near Pittsburgh.

FLOORS

"Since 1940 we have been interested in finding an ideal conductive flooring material for anesthetizing areas in hospitals. We have been searching for a floor that has appearance, wear, ease of cleaning, and special function of neutralization of electrostatic charges. Because of the nature of the material used in that type of structure, any conductive, resilient, or shock-absorbing floor is necessarily softer than the ordinary vitreous ceramic tile or cement installations, and is subject to indentation and other types of marring. Up until June, 1952, discouraging results were obtained. Many of the conductive flooring materials lost their conductivity after one to five years of hospital maintenance and use. Few of the cement terrazzo type of floors had to be

replaced because the matrix loosened with each mopping.

"Of the several flooring materials studied, three can be recommended on the basis of their performance. One is the conductive Vinylast, manufactured by the Vinyl Plastic Co., of Sheboygan, Wis. This vinyl plastic tile, measuring 9" square and ⅛" thick, is a tough floor covering that is cemented through a copper wire screen to any existing floor. It is resilient and easy on the feet and meets the present code requirements. It is furnished in mottlings of green and light gray colors. This material is recommended for existing hospitals because it can be installed without interrupting the surgical schedule. Additional information on the conductive Vinylast may be obtained from the Vinyl Plastic Co., Sheboygan, Wis.

"The second type: For new constructions, however, I believe that the vitreous ceramic tile flooring material, which also meets the present-day code requirements, is more durable. The small tiles are ¼" thick and require a 1" conductive underbed. At present this material is available in black and green tile combinations. To install these tiles the room must be vacated from seven to 10 days. Additional information may be obtained from the Olean Tile Co., Olean, N. Y.

"The third type is the carbon black floor installed in accordance with the specifications made by the Bureau of Standards and the Shawinigan Chemical Co., Shawinigan (Que.), Canada. (The latter is the manufacturer of the acetylene black used in the floor.) Our study of the carbon black floor installed in some of the hospitals shows fine hair-like cracks which are typical of all types of terrazzo floors. Some of these show high electric resistance four to five years after their installation. However, many have retained satisfactory electric conductivity.

"Because some of the carbon black floors show high electric resistance, I personally feel that metal dividing strips should be used in place of the nonmetallic type which are recommended by some authorities. Protection to personnel against power shock may be given through isolation transformers that should be part of all operating and delivery rooms in hospitals.

"A floor that meets the present-day requirements should have 25,000 ohms for the lower limits and 1,000,000 ohms for the upper limits. A happy medium is 250,000 ohms, which will protect personnel against power shock."

SHOES

Conductive-soled shoes are to be preferred. However, in the absence of such footwear you can use conductive stick-ons, slip-ons, or booties. The places at which you can obtain these are named in the accompanying lists.

Stocking feet are safe, but watch out for broken glass ampules!

So-called "conductive shoes" are not conductive if they are covered with the usual types of institutional floor wax. The soles of these shoes should be cleaned at regular intervals. That means daily. There are many detergents at the corner grocery store which can perform this task.

The only practical way of finding out whether shoes are conductive is to test them on an insulation tester.

The shoe tester made by the Conductive Research Associates is satisfactory for testing shoes, but it cannot be used for testing floors. I prefer equipment that gives reading in ohms for footwear and other items. A combination of floor tester and shoe tester which has been found satisfactory is manufactured and sold by the Conductive Hospital Accessories Corp. in Boston.

FLOOR WAX

Many hospital administrators and housekeepers dislike the appearance of the average operating room floor.

If the floors are made of recommended conductive material, they very definitely should *not* be waxed, unless a conductive type of wax is used. Be sure it is conductive before purchasing it.

A mild, non-greasy detergent can be used for cleaning. Washing floors aids the conductivity. Treat the clear wash water with calcium chloride one percent solution to provide a deep conductive layer. Consult conductive flooring manufacturers regarding cleaning. They will give exact directions.

GROUNDING

If there is a question of proper grounding in the operating room due to high resistance of the floor, I would suggest the use of three wet towels or any other sizeable pieces of fabric.

The first towel is folded lengthwise; one end is placed under the patient's shoulder, against the bare skin, and the other end is tucked between the mattress and the top of the operating table.

A second wet towel is laid above the caster from the base of the operating table to the floor toward the anesthetist's foot.

The remaining wet towel is stretched from the foot of the gas machine to the floor. The anesthetist's foot and the stool touch one or both of the towels. Wet towels employed in such a manner provide excellent interconnection and grounding, even though a standard test may indicate high floor resistance.

Conduction of electricity to ground through a floor is accomplished through many paths of high resistance. When a contact to the floor is made with a chair, plate, or chain, only a few of the available paths to ground are used. When contact is made through a large, wet towel, cloth, or pool of water placed on the floor, thousands of such paths are made available, and the neutralization of charges is accomplished easily.

BLANKETS

For many years we have thought we were fairly safe as far as blankets and sheets were concerned. Of course we have condemned woolen blankets but have accepted cotton blankets. Now the manufacturers have fouled us up again. Synthetic fibers (dacron, nylon, etc.) are being put in so-called "cotton" blankets. They create one more source of static electricity. Incidentally, there is another time-worn custom which also may get some of us into trouble. That is the practice of warming cotton blankets for use in the operating room. When cotton blankets or sheets are not warmed—that is, they are left at room temperature—there is apt to be a slight degree of moisture retained in the material.

This aids in the electrical conductivity and cuts down on the possibility of static sparks. Warming removes this moisture—and from the purely physiological standpoint a superwarmed blanket may be more harmful to a patient under anesthesia than one at room temperature.

There is a new little bulletin[4] which is published by the York Research Publishing Co., Inc., of Stamford, Conn., which I would like to recommend. This is what that company says of the bulletin: "A confidential monthly service to managers, purchasing agents, and housekeepers direct from the laboratory which specializes in the institutional field."

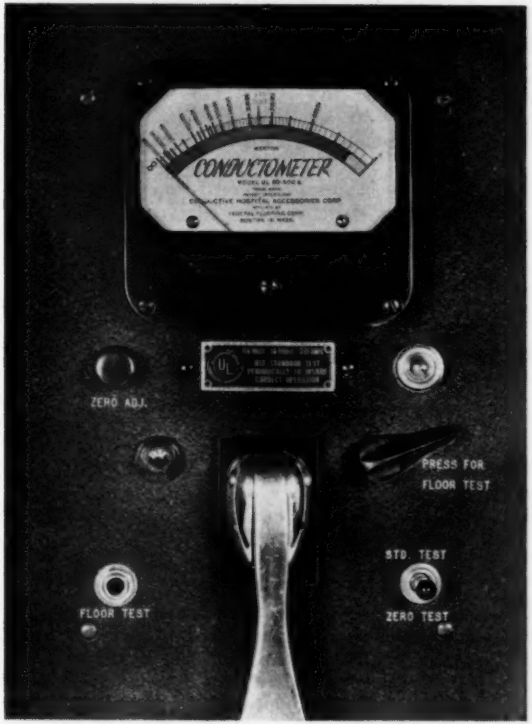
In Vol. I of this bulletin the following report appears:

"With the growing use of synthetic fibers (dacron, nylon, etc.) in blankets, pillows, and even sheets, many institutions have been confronted with the problem of static electricity.

"Our laboratory has made tests on an antistatic product called 'Negastat.' When used as directed, 'Negastat' prevents any build-up of static electricity, for extended periods. Further, this product does not change the appearance of the fabrics tested.

Static Resistance

"A Gardner washability machine was used in this



Conductometer (right), made by Conductive Hospital Accessories Corp., is designed for testing electrical resistance of operating room personnel, flooring, and equipment. It is flush mounted in the wall five feet above the floor, just inside the operating room entrance.

test. A three-pound load was placed on the abrasion boat and heavy black wool was used as the rubbing medium.

"A control sample of untreated plastic fabric was rubbed, and after five cycles (10 strokes) a static charge of 1.5KV/ft. was built up.

"A similar sample of plastic fabric was first sprayed with 'Negastat 105' and then exposed to the abrasion machine. The wool was used in order to create the static charge and was changed every 50 cycles to eliminate the possibility of 'Negastat' building up on the wool.

"After 3,500 cycles (7,000 strokes) there was no measurable static charge on a Baldwin-Dunlap Statigun.

" 'Negastat' comes in two forms: Pressurized for spraying on rugs and upholstery and in a solution to be used in the final rinse in laundering of bedding, uniforms, etc.

"While the antistatic qualities of 'Negastat' remain effective for a considerable length of time, 'Negastat' is removed in the laundering process and must be reapplied in the final rinse.

" 'Negastat' is manufactured by Phillips and Phillips Corp., 343 S. Dearborn St., Chicago 4, Ill."

HUMIDITY

We would be negligent if we did not say a few words concerning humidity—the relative amount of moisture in the air.

It has been a common belief among many anesthetists that an atmosphere of high humidity prevents accumulation of static electricity and thereby eliminates explosions caused by electrostatic charges. However, several explosions have been reported with the relative humidity at 65 percent. In 1949 an explosion attributed to a static spark occurred when the relative humidity was 76 percent.[2]

Air-conditioned operating rooms are desirable, but some authorities are of the opinion that artificially conditioned operating rooms are more dangerous than nonconditioned rooms, because of the removal of carbon dioxide from the air. These individuals believe that it is the carbon dioxide in the humid atmosphere which is effective in giving conductivity to insulators.

While this seems plausible, it is not altogether true, because most chargeable surfaces and insulators in operating rooms are contaminated with dust, soap films, and so on, which probably furnish more ions in solution than would be furnished by the carbon dioxide. Unless the relative humidity is high, it may not prevent the possible electrification of rubber parts. Furthermore, unless the equipment is in constant operation and in permanently good condition, it may fail to provide protection when it is most needed.

SAFE PRACTICE FOR CYLINDERS WITH COMPRESSED GASES

The Division of Simplified Practices of the National Bureau of Standards,[5] Washington, D.C., has recommended the following color markings for the gases concerned:

Oxygen—green

Carbon dioxide—gray

Nitrous oxide—light blue

Cyclopropane—orange
Helium—brown
Ethylene—red
Carbon dioxide and oxygen—gray and green
Helium and oxygen—brown and green

HANDLING GAS TANKS USED IN ANESTHESIA

We have all seen the occasional oxygen tank, especially the big "G" or "H" size, on which the cap covering the valve, or the valve itself, sticks or squeaks. Now an up-and-coming young maintenance man or even an old sage in that department may get into considerable difficulty, even lose his life, if he gets busy with his oil can on this squeaking valve or valve cover. *Do not* permit oil, grease, or flammable liquid to come in contact with oxygen cylinders, valves, regulator gauges, or fittings. Oils and greases in general are lightly oxidizable substances, and we all know that oxygen will support combustion.

Never oil or grease any anesthesia equipment unless a lubricant made for that express purpose is used.

Some other "do's and don'ts" connected with the handling of oxygen are on one of the accompanying lists.

In addition to the standard labeling and coloring of anesthesia gas tanks, we now have also the "pin-index" method for the proper attaching of anesthetic gases to gas machines. If you who are in anesthesia do not know about the "pin-index," ask your gas manufacturer —or, better yet, the manufacturer of your gas machine.

This safe practice, combined with the standard method of labeling all gases used in a hospital, will do much to cut down the possible hazard of connecting the wrong gas to the anesthesia machine.

MISCELLANEOUS

Never cover an anesthesia machine with a sheet or anything else. Removal of the sheet may cause static electricity, with explosion or fire resulting.

The cleaning of the patient's skin in preparation for surgery with ether and alcohol or any other flammable agents is dangerous practice. Not only may fire result from this practice, but also the patient may be burned by ether running down under him.

Obtain as much of the suggested reference material as possible— and read it. Try to make the necessary corrections in your present operating rooms. This is the only way we can make our operating rooms more nearly safe for our trusting public.

Remember: We can have an absolutely safe, if not practical, operating room, providing none us ever goes into it!

REFERENCES

1. A surgical nurse: Personal communication.
2. Thomas, George J., M.D., "Fire and Explosion Hazards in Hospitals," *Journal-Lancet*, Vol. 74, No. 10, p. 415, October, 1954.
3. Thomas, George J., M.D.: Personal communication.
4. York Research Bulletin, Vol. I, No. 1, January, 1955 (York Research Publishing Co., Inc., Research Dr., Stamford, Conn.).
5. "Recommended Safe Practice for Hospital Operating Rooms," National Fire Prevention Association Bulletin No. 56, May, 1954.

CONDUCTIVE MATERIALS OR AGENTS

● The following list of commercial firms is presented expressly as an aid in locating a source of supply of electrically conductive material. This list is, admittedly, grossly incomplete, insofar as indicating the number of places from which these materials may be purchased.

The listing here of a company, or other source of supply, does not necessarily imply that the products of that company (or other source of supply) are superior in any way to those products of many other sources of supply. Nor does the listing here of certain sources of supply imply, necessarily, that they are recommended by the author or by HOSPITAL TOPICS.

Conductive Rubber Parts for Anesthesia Machines

Ohio Chemical and Surgical Equipment Co.
1400 E. Washington Ave.
Madison 10, Wis.

H. E. Richards Co.
411 W. Bancroft St.
Toledo 2, O.

Gallaher, Inc.
4780 Warner Rd.
Cleveland 25, O.

Conductive Rubber Sheeting

American Hospital Supply Corp.
2020 Ridge Ave.
Evanston, Ill.

Conductive Rubber-Sole Shoes

American Hospital Supply Corp.
2020 Ridge Ave.
Evanston, Ill.

Conductive Slip-ons and Stick-ons for Shoes

Conductive Shoe Co.
P.O. Box 437
West Hartford, Conn.

Conductive Booties

Walter G. Legge Co.
Architects' Building
101 Park Ave.
New York 17, N. Y.

Insulation Testers

Conductive Hospital Accessories Corp.
82 W. Dedham St.
Boston 18, Mass.

Herman H. Sticht Co., Inc.
New York, N. Y.

Conductive Research Associates
29 Foxridge Rd.
West Hartford, Conn.

Conductive Flooring

Vinyl Plastic Flooring

Vinyl Plastic Co.
Sheboygan, Wis.
("Vinylast")

Robbins Floor Products, Inc.

Tuscumbia (Muscle Shoals), Ala.
(Lifetime vinyl all-purpose static-proof tile)

Vitreous Ceramic Tile

Olean Tile Co.
Olean, N. Y.

Terrazzo (with large or small marble chips)

Federal Flooring Corp.
82 W. Dedham St.
Boston 18, Mass.

Shawinigan Chemical Co.
Shawinigan, Que., Canada

Conductive Coating for Floors

Example: "Conducote"

Walter G. Legge Co., Inc.
Architects' Building
101 Park Ave.
New York 17, N. Y.

Floor Maintenance—Cleaning and Polishing

"Leco" Safety Floor Polish
"Texinal" Cleaning Compound

Walter G. Legge Co., Inc.
Architects' Building
101 Park Ave.
New York 17, N. Y.

Conductive Solution for Blanket Care

"Negastat"

Phillips and Phillips Corp.
343 S. Dearborn St.
Chicago 4, Ill.

Things to Remember*

1. Avoid wool, silk, nylon, sharkskin, nonconductive rubber, plastics, and so forth, in anesthetizing locations.
2. Keep away from the anesthetist and his equipment when using flammable anesthetic agents.
3. Use extreme caution in moving anesthetic appliances.
4. Exercise caution in connecting and disconnecting masks, breathing bags, or tubes, because handling may produce electrostatic charges.
5. Conductive-soled shoes should be worn by hospital personnel.

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*Most of this list was compiled by George J. Thomas, M.D., for the *News Letter* of the American Society of Anesthesiologists, No. 12 14:14-15, 1950.

6. Conductive floors should be installed in all anesthetizing locations.
7. All equipment on the floor should make proper electrical contact with the floor.
8. Paper wrappings should be removed before placing gas cylinders in service so that the cylinder labels may be clearly visible.
9. Purchase anesthetic gases from manufacturers who dispense their products in cylinders that are labeled and colored according to the recommended safe practice of the Bureau of Standards, Washington, D. C.
10. Do not permit oil, grease, or flammable liquids to come in contact with oxygen cylinders, valves, regulator gauges, or fittings.
11. Do not lubricate regulators, fittings, or gauges with oil or any other combustible substance.
12. Always clear the particles of dust and dirt from the outlet of each cylinder by slightly opening and closing the valve before applying any fitting to the cylinder.
13. Do not permit oxygen to enter the regulator suddenly. Open the valve slowly. When opening the valve, point the face of the regulator gauge away from the operator and other personnel.
14. Do not use oxygen fittings, valves, regulators, or gauges for any service except oxygen.
15. Gases should never be mixed in or added to an oxygen cylinder or any other cylinder by hospital personnel.
16. Do not attempt to use regulators that are in need of repair, or cylinders having valves that do not operate properly.
17. Do not attempt to repair defective oxygen equipment unless properly trained and qualified for such work.
18. Cylinder valves should be fully opened when in use.
19. Cylinder valves should be closed at all times except when gas is actually being used.
20. Employ block anesthesia or spinal analgesia or produce anesthesia with nonvolatile agents when these are suitable.

21. Use the carbon dioxide absorption technic in the administration of inhalation agents. The anesthetist should carefully observe the following routine: (a) Touch the patient and the gas machine before releasing any vapors or gases. (b) Bring the mask in contact with the face after it has been connected with the apparatus. (c) Allow only a nonflammable mixture to flow until all contacts are made. A low oxygen concentration might be used for the first half minute of the induction period. (d) Use deliberation in all movements. Break and remake connections of the mask with the patient and of parts of the breathing apparatus only when each part is in your own hands.

Finally, always be on the alert against that silent, unseen hazard that is the least understood and most neglected—"static or frictional electricity." A spark that can scarcely be seen or felt can prove disastrous.

RECOMMENDED READING

"Recommended Safe Practice for Hospital Operating Rooms"

May be obtained for 25 cents from:

National Fire Protection Association
60 Batterymarch St.
Boston 10, Mass.

"Static Electricity in Hospital Operating Suites: Direct and Related Hazards and Pertinent Remedies"

Bureau of Mines Report of Investigations 4833
United States Department of Interior, January, 1952

"Safe Practice for Hospital Operating Rooms"

Bulletin No. TB 10A-330
Veterans Administration
Washington 25, D.C.

Surgical Equipment Journal—Special Safety Issue, July, 1951

Ohio Chemical and Surgical Equipment Co.
1400 E. Washington Ave.
Madison 10, Wis.

Development and Function of the Surgical Committee and Its Value to the Operating Room Nurse

By John P. Garrison
Assistant Superintendent
Highland Alameda County Hospital
Oakland, Calif.

• *Here is another program speaker's paper from the Second National Conference of Operating Room Nurses held in St. Louis*

A COMMITTEE HAS BEEN defined as "a group of incompetents, selected by the unwilling to accomplish the unnecessary." This definition is from the same individual who insists that "an expert is one who can tell you exactly how to do everything, until it happens to him."

I emphatically do not agree with the first definition. The kind of committee I am going to discuss—a surgical committee—can be a very valuable aid to efficient hospital management.

In approaching my subject, I felt I was in an enviable position. We have an enthusiastic committee in our own hospital, and our operating room supervisor is chairman of the East Bay Operating Room Supervisors' Conference.

However, when we made a survey among the supervisors of 16 hospitals, totaling 2,116 beds, the results were dumbfounding. Only five hospitals had surgical committees. Two supervisors had no idea of what I was inquiring about, and one thought I wanted information concerning the medical staff surgical committee, which concerned itself with surgical competence only.

Concerning consultation on policy, staffing, procedures, and scheduling, it appears that the only person completely ignored was the night watchman. Anyone from the administrator on down might be consulted—or operating room personnel might work things out for themselves.

Consultation practices on the purchase of equipment and supplies were equally varied, although it seemed that the administrator was asked a little more often whether he had the money.

With the revelation that in a vast majority of institutions, large and small, no surgical committee existed, we naturally concluded that this paper should be aimed toward outlining the mechanics of forming a committee and what can reasonably be expected from one.

We decided to use our own committee in a re-audit of its organization and purposes. We called the committee together, outlined the general problem, suggested some methods of approach, cracked the whip softly, and got down to work. This paper is the result of our own reappraisal.

Some of our suggestions, because of the limitations of time, are going to be rather abbreviated. However, I believe our conclusions will be useful. They are divided into two principal elements, the mechanics of formation and functions of the committee and some of the areas in which the committee can operate, with particular emphasis on those questions which also affect other departments of the hospital.

COMMITTEES

I believe we can agree that groups tend to be superior to individuals in solving complex problems that do not fit into the customary framework of reference. But even though we have traditionally measured the value of committee work in terms of problem-solving, there are other elements of value to the hospital and to the operating room supervisor.

In developing a functioning committee, we should be aware of some of the general areas of purpose and value, not only to the supervisor, but to all members of the committee. The basic purposes are:

1. Problem discovery
   a. Recognition of the barriers that exist in your organization
   b. Recognition of interdepartmental problems as they arise
   c. Encouragement of the submission of problems by your subordinates
   d. Survey of each decision in the light of the collateral problems it may create.
2. Problem-solving
   a. Utilization of the varied backgrounds, skills, and experience of the conferees
   b. Taking advantage of the creativeness of individuals
   c. Providing a freshness of approach. New twists sometimes make even old problems solvable
3. Interpersonnel relationships
   a. Providing a better understanding of the need for cooperative action
   b. Providing the understanding of others' viewpoints
   c. Speeding up the time necessary to change and accomplish things

4. Improvement of the execution and acceptance of decisions
   a. Keeping decisions within the authority prescribed
   b. Clarifying any aspects that are difficult to grasp
   c. Need for decisions which not only meet with approval of your superiors but also receive the understanding of subordinates who are to implement them
   d. Coordination of personnel to provide a uniform pattern of communication and execution.

The participating individuals benefit from committee work by the development of their knowledge and skills and also the modification of their attitudes.

After the dream should come the realization that a committee is not in business just because you call a group of people together. In developing a committee, we must first recognize some limitations:

1. This is to be a surgical committee, dealing with surgery and related areas, not a little kingdom set aside to dominate or settle the fate of the hospital.

2. The committee will work only as well as you are willing to make it work, by devoting time and effort to it.

3. Other personnel have their own special brands of headaches. They might even have some legitimate gripes about surgery.

4. Your administrator is responsible for the administration and coordination of policy, and for making the hospital run. He is not going to be able to devote all the time you would like to the committee. So resign yourself to doing most of the leg work, particularly after the formative stage.

Now, if you have decided that a committee is desirable, there are a few simple suggestions to follow in your creative effort:

1. Prepare a comprehensive plan in outline form.

2. Justify your purposes, methods and procedures.

3. Request review and suggestions from the people you expect to participate in the working committee.

4. Summarize, stating your conclusions simply and clearly.

5. Transmit the complete plan to your administrator. Allow sufficient time for his study and coordination with other activities, and follow up for his decision.

MEETINGS

Meetings are the vehicle of your objectives, but there are some generally accepted principles concerning them.

Control: The administrator or his designate must control the committee, particularly in the steering stage. He has the total responsibility for the determination and administration of policy. He may delegate this authority later, as leaders are developed.

Regularity: Meetings should be held at regularly stated intervals at a definite time, and should be limited to not more than one hour for the best results. Have as many as you need to accomplish the job, but keep them at regularly stated intervals.

Agenda: Adequate preparation is essential. Gather subject matter from participants or others at a fixed time before the date of each meeting. Prepare a summary in advance and distribute to the participants. What should the content be? It may present a problem, a condition, or a

controversial question. Material should be stated clearly and concisely, with any supplemental data necessary for understanding. It must be within the experience of the conferees, and should lend itself to solution or treatment.

Records: A permanent record should be kept of committee proceedings. Copies should be distributed to all participants.

MOTIVATION

The greatest danger to commitee work is that the participants will get fed up with the idea through sheer boredom. The remedy is to make the meetings so alive, interesting, and meaningful that a member will miss something good if he stays away.

How can you do that? By keeping them timely, of material value, of real importance; by encouraging full membership participation; by introducing new ideas and methods, such as case problems, demonstrations, pictures, and panel discussions with others.

Develop a feeling of accomplishment by the committee, through efficient follow-up and frequent progress reports.

PERSONNEL ON COMMITTEE

There are many possible combinations of personnel for a surgical committee. Each committee will vary with the needs of each hospital. There are, however, certain individuals and areas of responsibility that should be regularly represented:

1. **Administration.** The administrator is responsible:
   a. To the governing board for efficient management
   b. For liaison between departments
   c. For the selection and competence of personnel

(L. to r.): Sister Mary Clement, R.N., St. Vincent's Hospital, Monett, Mo.; Sister Mary Evangelista, R.N., St. Judes Catholic Hospital, Montgomery, Ala., and Sister Mary Edwin, R.N., St. Vincent's Hospital, Monett, Mo., stopped in at the HOSPITAL TOPICS booth during the A.O.R.N. convention in St. Louis.

d. For the approval or disapproval of all committee work and decisions.

2. **Chief of staff.** He:
   a. Represents the liaison with the medical staff
   b. Suggests methods of enforcement of surgical rules and procedures
   c. Provides consultation on standards of surgical nursing

3. **Anesthesiologist.** He:
   a. Determines scheduling
   b. Decides how many and what anesthetics to use. (NOTE: If the hospital does not have an anesthesiologist, the nurse anesthetist or the committee can take over this work.)

4. **Director of nursing.** She:
   a. Provides coordination in staffing
   b. Presents ward problems as they relate to surgery
   c. Ascertains that demands on nursing are reasonable

5. **Operating room supervisor.** Obviously, here is the prime mover and coordinator of activities that surround surgery.

6. **Other consulting or regular members.** These might include:
   a. Recovery room supervisor
   b. Central supply room supervisor
   c. Medical records librarian
   d. Resident and assistant residents in surgery (if included, they should be rotated for equal educational opportunity)
   e. Others, for specialized problems (the housekeeper, for any housekeeping problems, for instance).

Our hospital has a basic committee which serves the needs of all departments, including surgery. Membership is flexible. When a problem directly concerns only a few persons, just those persons are asked to meet to consider it.

If a problem is strictly surgical, the following would usually be included: the administrator (or his representative), the chief of surgery, the operating room supervisor, and the director of nurses, and any other person or persons directly concerned with the problem under discussion. In other words, we feel there is no need to tie up the time of everyone on the committee if the problem can be satisfactorily resolved by a few persons.

PERSONALITY PROBLEMS

In any group there are always personalities. The supervisor, as a leader, must know how to cope with these types, probably familiar to all of you:

1. The individual who talks too much. Since one of the purposes of these meetings is to exchange ideas, the leader can say during a pause, "What do the rest of you think about this point?"

2. The quiet one. Here encouragement is needed. There are many ways the leader can provide it. She may ask, "Didn't you have such an experience?"

3. Others—including the member who knows all the answers; the member who tries to make an impression; the member who wants to dominate the meeting; the member who takes a long time to express himself; the member who starts a conversation with his neighbor.

The technics of handling these situations are very adequately covered in a publication of the American Hospital Association called "Conference Technics," part of a series

on hospital personnel administration. I recommend it to you for review.

Even though we are advocating the establishment of a surgical committee, whose problems will be principally surgical, we would like to bring up some problems that touch upon other departments in conjunction with surgery. The range of committee activity can be very wide.

SUGGESTIONS FOR COMMITTEE WORK

These suggestions for committee work, as in the mechanics of a committee, are for you and your hospital. There are enough, with what you are getting at this meeting on pure surgery, to keep you busy for the next five or 10 years.

1. **Control**
   a. What emphasis should be placed on supervision?
   b. Who is to coordinate divisions of work and responsibility?
   c. How often should procedures be re-audited to eliminate those that are no longer practical?
   d. Should we have central control of scheduling and starting operations? If so, how?
2. **Design, construction, and modification**
   a. What is the related value of facilities in your hospital? In discussing revisions, one of the basic questions is "Whom are we going to take the space away from?"
   b. We have placed great emphasis on explosion hazards in surgery. How about using this experience in other areas of exposure in the hospital?
3. **Technics**
   a. Sterilization
      (1) What about testing devices and their reliability?
      (2) What temperatures destroy textiles? Other supplies?
   b. Disinfection
      (1) What are the general properties of chemicals and detergents?
      (2) How should sutures be prepared and cared for?
      (3) What are the sources and how do we control airborne infections?
      (4) What is the filtering efficiency of face masks?
      (5) What is the role of the administrative and professional staff in the control of infections?
   c. Patient care
      (1) What home care and rehabilitation should postsurgical patients receive?
      (2) How should surgical personnel be kept up-to-date with the trends and changes in ward nursing?
      (3) What are the common causes of postoperative reactions?
4. **Supplies**
   a. What economies can be introduced in the use of supplies?
   b. Should the hospital buy or manufacture surgical dressings?
   c. Should used gauze be reclaimed?
   d. What is the efficiency of various types of dusting powders?
   e. What are the limitations of adhesive plasters?
   f. What are the properties of various types of soaps?

- TOPICS reporters visiting

5. **Central supply**
   a. What should the central supply room supply?
   b. Should the department's control, organization, and staffing be reviewed?
   c. Are all methods reviewed periodically?
   d. Is the flow of work really efficient?
6. **Outpatient service**
   a. What surgery may be done safely in the clinics?
   b. What types of anesthesia may be safely used?
   c. Are periodic reviews of new supplies and medications made as they apply to clinics?
   d. What about review of administrative problems that arise from the rotation or assignment of personnel to clinics?
   e. How is followup scheduled in clinics?
7. **Medical records**
   a. Do you have a periodic review of rules and regulations?
   b. What about refresher courses in medico-legal problems?
   c. What do records (surgical, anesthesia, recovery room, log books) contain? How are they prepared and maintained?
   d. Are records reviewed periodically for modification and change?
   e. What dictating procedures are used?
8. **Other areas**
   a. Have you considered educational programs for others?
   b. Have you ever considered the value of music for personnel and patients?
   c. How much color should be used?
   d. What are important do's and don'ts for brace shops?
   e. Have you ever considered a transfusion service?
   f. What about specialized instrument controls?

The picture at left was taken at the A.O.R.N. conference in St. Louis.

Practical Devices for

● TOPICS reporters, visiting operating rooms in hospitals all over the country, run across many practical devices built right in the hospital in answer to a supervisor's specific need, and often patterned after her design.

Here are a few ideas from Mrs. Ida Conner, O.R.S., Santa Clara County Hospital, San Jose, Calif., and Arlene Cumming, O.R.S., Bernalillo County-Indian Hospital, Albuquerque, N. M., which may prove helpful in your hospital.

Above: Arlene Cumming, O.R.S., Bernalillo County-Indian Hospital, Albuquerque, N. M., with handy shelf storage boxes built by hospital carpenter, shown here holding 4x4's and gloves, but also used for neat, compact storage of sutures, lap tapes, etc. Boxes also are used for holding bandages.

Left: An old bassinet at Santa Clara County Hospital is used as a rack for sterilizing gloves, to keep them from coming in direct contact with the walls of the autoclave.

Operating Room Use

Above: Old metal bassinets don't go to waste at Santa Clara County Hospital. In supply room for the O.R., one here serves as wall rack for holding all small packaged supplies. Large O.R. packs are done in the laundry.

Right: Mrs. Conner shows board used for holding blood and IV standard on stretcher when patient is being taken from the operating room to the ward. The board, built in the hospital carpenter shop, slides under the padding on the stretcher. The standard, which is removable, fits into a metal tab on the board.

The O.R. Problem Clinic

by EDITH DEE HALL, R.N.

Mechanical Unit Aids in Hypothermia and Hyperthermia

● Operating room nurses welcome new equipment that is beneficial to the patient and helpful in eliminating some of the demands upon nurses' time and energy. This is true of a mechanical unit which was originally designed to replace hot-water bottles and ice bags but which has initiated many new developments through intensive scientific research.

The mechanical unit is designed to provide a wide range of thermostatically controlled body temperatures. It has been used to reduce high temperatures in the acutely ill preoperative patient, to prevent heat retention during surgery, and to treat hyperpyrexia due to infection and other causes. The unit may be used to provide local refrigeration for amputations and also for the preservation of limbs for

long or short periods. This preservation is valuable in allowing time to treat the patient for shock and take supportive measures to build up strength for surgery, following traumatic injuries. As an anesthetic agent, hypothermia is applied in conjunction with drugs and has had some use in general and neurosurgery.

Although the use of hypothermia in cardiovascular surgery is not widespread, it has been used successfully on selective cases. The relative simplicity of the technic is an advantage. Enough anesthesia is given to prevent shivering and to keep the patient comfortable. By lowering the body temperature, oxygen requirements are reduced so that total vascular occlusion at the heart may be sustained long enough to perform deliberate anatomically precise operations within the heart. With hypothermia all circulation including the coronary flow is stopped while the heart is open. When the surgeon is sewing up, hyperthermia is started.

Hyperthermia provides a method for the medical application of heat and may be used following hypothermia to restore normal body temperature. Restoration, by means of thermostatic control, may take place as gradually or as quickly as the surgeon desires. The procedure is simple, and the chosen temperature may be maintained at a constant level.

The cabinet of the hypothermia-hyperthermia unit contains a motor-driven pump, a tank and coil for the refrigerant solution, and a condenser and heater which are controlled by a thermostat. The temperature of the solution can be raised, lowered, or maintained at any given point, and can be clinically applied to the patient. The pressure gauge, controls, and thermometer are mounted on top and are simple to operate. The refrigerant solution is circulated through rubber tubing channeled between layers of rubberized fabric which is made into blankets. A complete circulation of the refrigerant solution takes place approximately every 30 seconds. A continuous record of body temperature is maintained by use of a nasal or rectal type thermometer. The blankets or applicators come in various sizes and shapes for convenience and efficiency in applying externally the desired temperature to the whole body or to any part. They are flexible and therefore conform to the contour of the patient's body.

During surgery the unit is the responsibility of the anesthesiologist, who with the surgeon determines how it will be used and the exact procedure. After surgery it may be the responsibility of a nurse to care for the equipment. The blankets should be disconnected and cleaned. Since they are rubberized on both sides, this can be done by sponging with an antiseptic soap solution. They should then be wiped dry and powdered lightly. Routine care should be given the machine so that it is always in good order.

A great amount of research is being done in the use of cold in medicine and surgery. New technics are being tried in laboratories, and as progress is made new mechanical devices will be designed. When new developments affect the surgical patient, operating room nurses co-operate by helping doctors improve procedures.

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Planning and Management of the Recovery Room

By Elliott Hurwitt, M.D.
Chief, Surgical Division
Montefiore Hospital
New York City

(The following paper was presented at the A.O.R.N. convention held in St. Louis, January 24-27, 1955.)

• My material has been divided into five basic questions in reference to a recovery unit: WHY, WHERE, HOW, WHO, and HOW BIG.

The answer to WHY is not hard to find. I was under the mistaken impression that the modern interest in recovery suites stemmed from our experiences during World War II, when all of you who had an opportunity to work in military installations became acquainted with the tremendous advantages of having a shock ward, a receiving ward, a recovery ward, where patients could go after surgery and remain under the supervision of nurses specifically assigned to these units. Even on the Navy hospital ships at sea, we took advantage of this opportunity, and it made an enormous difference in the handling of patients. So I was surprised when Miss (Edith Dee) Hall told me that when she was a youngster about my age every hospital had recovery units—that this idea had been tried, and for some reason not completely understood, had not been continued.

But I think it required the lessons of this last war, particularly the tremendous advances made in resuscitative therapy, the availability of blood transfusions, antibiotics, parenteral fluids, and oxygen therapy—all these things, concentrated in a recovery unit, to give the unit great meaning.

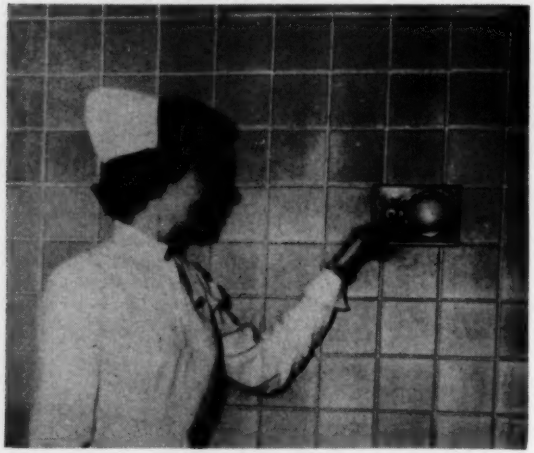
So the WHY of a recovery unit is to set up a place where patients after undergoing surgery can be concentrated in a unit that will be thoroughly equipped; that will be staffed by a permanent staff of recovery room nurses; that will eliminate transporting unconscious or semi-conscious patients through hospital corridors, letting them get stuck in elevators, or be exposed to drafts, or swallow their tongues when

Above: Nurse's station is in the middle of unit. Door at far end leads to operating room suite. On the same side of the corridor as the nurse are two two-bed units. One in foreground is an isolation unit that contains its own sink and has an ultra-violet ceiling lamp. This unit is used for patients recovering from tuberculosis pulmonary resection. The hospital has a great deal of these cases. Patients are put in the unit with their own nurses. At left of nurse's station is another two-bed unit used frequently for pediatric surgery. It contains an Isolette unit, and can accommodate three children or two adults. Across the corridor are four sealed units, walled in up to a height which permits nurse to see all patients at all times.

there's nobody around to pull the tongues out; that will prevent them from going into shock in transit with nobody or nothing available to correct the situation.

I'm sure all of you, if you think hard enough, can remember at least one, perhaps several, instances in which patients, after leaving the operating room in apparently good postsurgical condition, were dead by the time they reached their rooms on a floor that could be a short distance or a long distance from the operating room.

Below: Utility room in unit includes Executone which is turned on. Bed pan sterilizer is also included in this room.



Such sudden deaths have occurred after very simple operations, after herniaplasties, after gallbladder operations. I can recall a hysterectomy patient to whom this happened.

These tragedies can be eliminated by having a recovery unit. If one patient is saved by such a setup, you need no other reason why the unit is no longer a luxury, but a necessity.

The next question is "WHERE should the recovery unit be?"

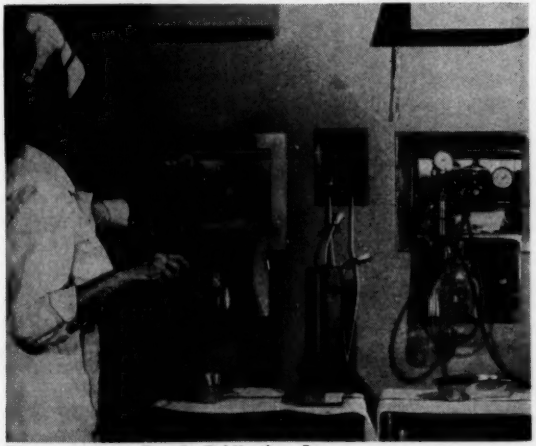
There's no such thing as a universal blueprint for a recovery unit, that each of you could adapt to your particular hospital. The plan will depend on the physical construction of your hospital; on available space; and, to a large extent, on the type of case load that your particular hospital handles, because concentrations of different kinds of material in different hospitals make different needs arise, and I will illustrate that a little further on.

Our recovery unit is all on one floor level, the ground floor, which makes it necessary that the unit be air-conditioned and humidity-controlled. Of course, air-conditioning is desirable in an operating room or a recovery unit, anyhow.

The recovery unit is directly in continuity with the operating room suite, and patients are brought from their rooms through a very short stretch of corridor into the recovery unit. The more intimately the recovery room is in contact with the operating room, the shorter the trip will be, the better liaison there will be between the O.R. and the recovery unit, the greater the availability of doctors at all times for the recovery unit.

Beds used in the recovery unit are taken to the operating room. The patient is lifted from the operating room table to the recovery unit bed. There is no intermediary stretcher.

The blood bank is part of this same suite. Directly across the corridor, a very short distance away, are the hospital pharmacy, the x-ray department, and central supply.



Picture courtesy Parade Publication, Inc.

Above: Closeup of one of the rooms with two units, showing wall oxygen and suction outlets, blood pressure apparatus, overhead lights, and, between oxygen and suction equipment, an intercom (Executone) which connects with nurse's station, permitting nurse to hear patients breathe or groan, to hear their every request.

If you can organize a concentration of your basic patient care facilities to this extent, you will minimize problems that might arise and have a very smoothly operating area.

There is a waiting room in which relatives of patients can sit and wait for bulletins about the patients in the unit. When patients stay in the unit for any length of time, we permit one relative to visit the patient—not one relative at a time, but only one relative, no matter how long the patient stays there. That relative may come in and out and stay for a minute or so.

We're in the process of growing out of the recovery unit by taking over this room and expanding our facilities, so that we will have, in addition to an eight-bed unit with a nurse's station, facilities for six or even eight or 10 additional patients, who will be short-term patients.

The next question is "HOW is such a recovery unit run? How is it staffed? How is it equipped? How are its daily functions carried out?"

The recovery unit should be staffed by a permanent group of nurses, just as the operating room is staffed by permanent operating room nurses. They shouldn't be girls who are pre-empted from one floor or another at odd times, disrupting patient care in other areas of the hospital. They should be a team of girls employed for this purpose, with a graduate registered nurse in charge, and as many other graduate registered nurses as can be corralled to make up the rest of the staff.

The unit should be controlled from a nursing point of view, we believe, not by the operating room supervisor, but by the nursing office, under the direct supervision of the surgical supervisor, who is in charge of the rest of surgical patient care in the hospital.

The liaison between the operating room supervisor and the recovery unit supervisor has to be very close. The operating room supervisor notifies the recovery unit supervisor when a patient is about ready to be transferred to the unit, but that is not as formidable as it sounds, because these girls are working in offices right next to each other. It's essential that this liaison be of the closest, because the flow of traffic at times can reach peak loads when the recovery unit is jammed, when transfers have to be made out in order to receive patients coming in. In many hospitals the recovery room actually functions under the supervision of the operating room supervisor, and this system probably works very well.

Professionally, the recovery unit is administratively under the direction of the chief of the surgical division, in whose department the anesthetists also function. No patient can leave our recovery unit until he is signed out in a book by a member of the surgical or anesthesia staffs.

A question that is always asked is "What is the cost of running a recovery unit—the cost to the hospital, the cost to the patient?" At our hospital ward service patients are not charged for the recovery unit, just as they are not charged for the operating room.

Private patients with their own private duty nurses are not charged for the recovery unit. They simply pay for their specials, who take care of them in the recovery unit under the supervision of the unit's supervisor.

For semi-private or private patients without special duty nurses (the category in which most of our patients belong), there is a charge of approximately $1.50 an hour while the patient is in the recovery unit. The insurance programs do not cover this. At the end of each month the hospital may be $5 ahead or $5 behind, but I think most hospitals can absorb this budget item.

The next question is "WHO should go into the recovery unit?" We believe that all patients, whether they've had general anesthesia or spinal anesthesia, should go into the recovery unit until they have reacted, until they've stabilized as far as pulse, blood pressure, and respiration are concerned, to the extent that most of them have received their first postoperative sedation before they are transferred out.

Length of stay can vary tremendously in time, ranging from a half hour or an hour for short-term patients to at least overnight for most of our chest cases and all of our cardiac cases. Cases have been kept in the recovery unit for as long as six or seven days when they've been in critical condition and the services of the recovery unit or the operating room might be needed at any time.

Once you set up the unit on this principle, you no longer have strictly a recovery unit, you no longer have strictly a postanesthesia unit—you have a combination of recovery, postanesthesia, and group nursing all rolled into one. This is the reason we have had to

Below: Patient is received in unit. Doors are wide enough to permit beds to enter with ease. Bed has no side rails. Blood transfusion is running. Notice that patient's head is on the far wall, so that all patients will be facing nurse sitting outside in the center.

Picture courtesy Parade Publication, Inc.

expand our present facilities, taking over the additional room, where we will not put cubicles, but have curtains in tracks separating six, eight, or 10 bed stretchers where the short-term patients, who will be known to be fit for transfer within an hour or two, will go during the immediate recovery phase. This room will be more truly a postanesthesia room.

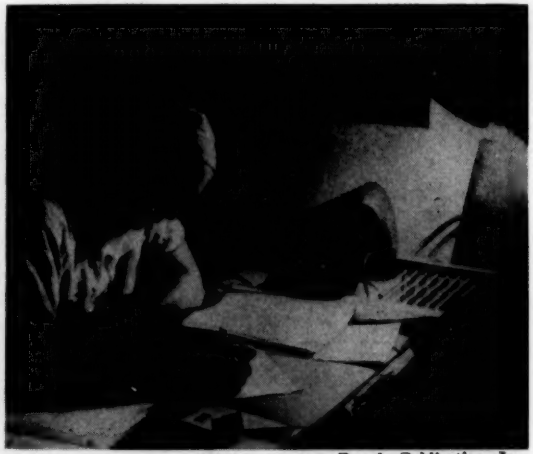
How long a patient should remain in the recovery

suite is really a personal question. It has been suggested that as a rule a patient should be in the recovery unit as long as he's been in the operating room, but the length of time will vary tremendously with the type of case load in your particular hospital. Where a great deal of intracranial and intrathoracic surgery is done, patients will have to remain in the recovery suite longer.

When the bulk of your patients are short-term elective surgical material—gynecological, hernia, and gallbladder patients, for instance—obviously the stay will be much shorter. But to predicate a stay based on the time in the operating room would be extremely fallacious, as illustrated by a recent situation in our hospital.

I was doing a mitral commissurotomy in one room; a lobectomy for tuberculosis was going on in another room, and in the third room was a patient scheduled for a pneumonectomy for carcinoma of the lung. The pneumonectomy turned out to be inoperable. The lobectomy took between six and eight hours, and the patient with the mitral valvular lesion was out of the operating room in less than an hour. But that patient was in no shape to be moved from the recovery suite in an hour, or even two hours, because all these patients have under-water drainage tubes. We take portable x-rays in the recovery unit on all of them the next day. So they all have to stay overnight. Therefore, the length of time in surgery really has little relationship to the time in the recovery suite.

The last question is "HOW BIG should a recovery unit be?" The Public Health Service states that in hos-



Picture courtesy Parade Publication, Inc.

Above: As patient is brought into the recovery unit, member of the resident staff comes in and writes the orders and transmits them to nurse in charge, so that there's no gap in this transition. Under gooseneck lamp is recessed chart rack, where all patient charts are kept while patients are in the unit. There is no special recovery room chart. Unit does have recovery room records, which become an integral part of patient's record when he is transferred from the unit. There are two telephones in the unit—a conventional one, in front of chart rack, so that nurse can call out for help whenever she wants to, and a second phone, with no dial, labeled, "Emergency Only." Recovery unit nurse can pick up this phone at any time, get the hospital operator, and get anything she wants in a hurry. In background are cubicles in which pediatric patients are kept.

pitals having four or more operating rooms, there should be as many beds in the recovery unit as there are operating rooms, plus one, or plus two.

Detailed lists of supplies, equipment, spatial requirements, organization, and fine technical details you might need to know, were given by the Public Health Service in the November, 1952 issue of **Hospitals**. I recommend that article as a primer in recovery suite organization.

John Thompson, assistant director, Montefiore Hospital, New York City, who has been in charge of our recovery suite and operating room suite since it was reorganized, will be happy to answer any inquiries.

In July, 1954, Parade Magazine, a Sunday supplement syndicated throughout the country, published a study of our recovery suite, including some excellent photographs. This article should be available in your local libraries.

Picture courtesy Parade Publication, Inc.

Right: Blanket-warming closet in utility room. Patients are covered with warm blankets as soon as they're brought into the unit.

"No" says this administrator!

Should the Operating Room be a Separate Department?

By Max E. Gerfen
Administrator, Sequoia Hospital
Redwood City, Calif.

SHOULD THE OPERATING ROOM and central supply be operated as a separate hospital department? I say, "No."

Today we in hospital management are vitally concerned with management methods, procedures, work methods, operating efficiency, and ways to reduce unnecessary functions. We are looking toward new products, labor-saving devices, and machines to improve service. We look to these functions, not with the thought of reducing payroll, but with the hope of keeping costs down and improving efficiency of management. For our particular subject, let us examine the question from the following standpoints:

(1) The medical staff
(2) Operating room personnel
(3) Supplies
(4) Surgery supervisor
(5) Patient service
(6) Floor-O.R. service
(7) Management

THE MEDICAL STAFF

From the standpoint of the surgeons, it does not appear that they would be affected. Probably it would make no

material difference to the individual staff man, as long as he received good service in the department. It is possible that a separate department might be more subject to direct pressure from the medical staff with respect to personnel and supply procurement. Let us say that an individual surgeon might, for some reason, dislike a particular nurse or aide. He could daily make known his dislike to the supervisor, who might in time resent such direct action. Friction could develop.

The same principle could hold true on supplies. With an active staff of 20 or 25 surgeons, the supervisor might, in time, be subject to the individual desires of the staff. When the department is an integral part of the nursing department, the supervisor merely refers the requests to the director of nursing, and an objective study can then be made by management—without pressure.

OPERATING ROOM PERSONNEL

We are all aware of the tendency toward formation of small groups within the hospital. When this happens, trouble soon develops. Whether or not there is justification for friction, gossip and insinuations will result. To separate the O.R. would tend to widen the gulf that too often exists under the conventional setup.

The operating room personnel should be part of the nursing team for the purposes of better patient care, cooperation with floor units, morale, and general effectiveness. When a specific nursing problem develops between the floor units and the O.R., the director of nursing services can make the decision as to procedure when the departments are combined. Under separate departments, a major rift could become a management problem.

Mr. Gerfen (l.), looks over hospital plans with George B. Walsh, president of the board, Sequoia Hospital.

All employees desire to work in a hospital in which friendliness and congeniality are evident. My opinion is that it is more difficult to achieve this status when too many divisions are created. Housekeeping, laundry, and maintenance services are now combined under one department in many hospitals. We have such a setup under the director of property and supplies. From the standpoint of the employee, a team spirit is more evident under a combined setup.

SUPPLIES

With respect to supplies, I see no problem under a separate system. Possibly a more frequent demand for individual tastes would occur. Requisitions may be fewer if checked by the director of nursing. Floor supplies may be reduced in a combined department through elimination of duplication. There appears to be no important problem under either system.

SURGERY SUPERVISOR

How would the supervisor be affected under a separate system?

First, her administrative status would be changed to the same level as that of any other department director. Hence, her personal status would be elevated. On the other hand, there might be some accompanying factors which would add to her already busy day. She would have many more administrative functions that would require her time. Department head meetings, payroll problems, termination interviews, employment-personnel problems, policy meetings, and other functions would complicate her work day.

Some O.R. supervisors might desire such increased responsibility. However, I believe that to institute separate status for the O.R. would only duplicate the administrative setup for nursing and add to the cost of the hospital. The surgery supervisor would need more clerical assistance, which again would duplicate functions already being performed.

Moreover, the surgery supervisor might have different internal personnel policies, and eventually a problem would arise between the O.R. and other nursing functions. From the standpoint of the surgery supervisor, a separate department would again appear to do nothing except add to her paper work and also possibly elevate her individual status.

PATIENT SERVICE

This is the most important point to consider. All persons in the hospital have but one duty—the best possible service and care to the patients. I know we all agree on that principle. I am convinced that we should treat the patient as a whole human being.

If we agree on our purpose, it follows that nursing in all its phases is a whole function, not a service to be divided into small units. When one person is responsible for the administration of all nursing services, better care is the result. The reason is team cooperation. No blocks of departmental lines are present under the whole nursing

system. Divided responsibility is eliminated. Buck-passing is not present. Care of and service to the patient are maintained on the highest standards under one nursing department. From the patient's standpoint, it is desirable to have a fully coordinated, cooperative nursing unit.

FLOOR SERVICE

Now let us look at the question from the standpoint of floor service. All of us realize that it is sometimes necessary to interchange personnel and supplies because of sickness, vacation, or other emergency needs. While this type of cooperation could be achieved under a separate setup, unquestionably a psychological block, at least, would be present.

Under an integrated plan the assignment of personnel and distribution of supplies and equipment would be a matter for the director of nursing only, thereby eliminating time-consuming discussions with another department head. Then, too, the floor personnel feel more closely associated as a team when operating room personnel are a part of that team.

All surgery nurses should be encouraged to follow up the cases they have assisted in surgery by visiting the patients on the floor. Visits should be made with a nurse from the floor. Together the nurses will reflect the interest and service on a high-standard basis.

MANAGEMENT

Management desires to achieve work simplification. To do this, a study of procedures, methods, equipment, and use of personnel is essential. Management has been aware that small groups or departments tend to form cliques which may be detrimental to the over-all objective. Like services should be grouped. In fact, the tendency in large, progressive hospitals is toward only two departments—professional care and service. In this setup the administrator has two assistants, one charged with the responsibility of rendering care to the patient and one charged with the responsibility of rendering service.

To carry the separation principle a bit further, if it is good for the operating room to be separated, then it follows that the delivery room should also be separate, and then why not the nursery, the emergency room, and outpatient services? I believe this type of organization would soon result in a lower standard of care to the patient.

When all factors are objectively considered, separation of the operating room from the nursing department is not good hospital management.

The Other Side of the Issue:

The Operating Room Should be a Separate Department

By R. W. Blaisdell, Administrator
Peninsula Hospital, Burlingame, Calif.

THE OPERATING ROOM *can* function efficiently as a separate department. Our success at the Peninsula Hospital in separating the operating room from the general nursing service has convinced us that the operating room supervisor should be a department head.

A basic concept of management, whether in or out of the hospital field, is the principle of "span of control." Too frequently administrators are unaware of or are unwilling to recognize the application of this principle in their organization. It is nothing more than the logical arrangement of the organization so that (1) related technical duties are performed under one jurisdiction and (2) one supervisor is not responsible for too many people doing many unrelated things.

The application of this principle to the operating room depends entirely upon the admission of or recognition of the technical differences that exist between (a) a staff nurse and an operating room nurse and (b) patient bed care and operative nursing.

In these days of postoperative recovery rooms, intensive and diversified surgery, and very active emergency departments, it is a fallacy not to combine these three areas of intimately related functions which require the same level of specialized nursing, the same instruments, the same supplies, and the same working conditions. The head of this combined activity should be the operating room supervisor. Furthermore, she should report independently and directly to the administrator or an assistant administrator.

It is far better to give the operating room supervisor the departmental status consistent with the responsibility that she has always had. This departmental status is even more important in the face of the increasing complexity of the work she is being asked to do.

Basically, the persons in a hospital organization who have almost continuous contact with doctors doing surgical work are the operating room supervisor and the administrator. Surgical problems can best be resolved by the doctor and these two persons. To inject a fourth party (the director of

nursing) into this picture does not contribute to the surgical function whatsoever.

Let's face it, one in 100 nursing directors have surgical backgrounds. The assignment by them of skilled surgical nurses to unknown tasks within the operating room is not good management. Such administrative nursing personnel are often not capable of making procedural decisions for the operating room. They cannot give understanding to the selection, control, or budgeting of surgical supplies and equipment.

If the over-all function of the operating room is recognized to the extent of making the operating room supervisor an independent department head, then when the director of nurses and the operating room supervisor meet, they are on common ground as two department heads, and not as superior and subordinate, respectively. Those areas of their responsibilities that *do* overlap slightly will be better understood and resolved for the over-all benefit of the patient, the doctor, and management.

Although the pattern or organization in the majority of hospitals in this country finds the operating room as an unintegrated division of the general nursing service, the best reason found to date for continuing this practice of unsound management is, "We have always done it that way before." This type of rationale refuses to recognize the changes that have occurred in the field of surgery. If we would carry out the proposals of the violent opponents of separate operating room departments to the extreme, we could do surgery in the patient's bed in his room and do away entirely with the operating room.

To make sure that no ill will is engendered or implied towards nursing service as a whole, let us right now recognize that general nursing is a well-defined discipline encompassing a vast area of infant, child, and adult care. If we leave the operating room out of the picture, the general nursing department still has a monumental task of staffing and administration in order to render its basic service obligations to the remaining portions of the hospital.

In addition, general nursing has those logical central supporting services that assist in carrying out the nursing care program. For instance, gloves, treatment trays, oxygen and suction equipment, IV solutions, bed and orthopedic apparatus, autoclaving, etc. *are* intelligently grouped in central sterile supply departments. These should logically be under the authority of the director of nursing. All functions mentioned above should be carried out by central supply, for all other hospital departments—x-ray, clinical laboratories, or the operating rooms themselves. This is recognized as true integration of many functions previously performed on a decentralized basis.

However, the operating room is still a separate entity performing a highly specialized service during a relatively short portion of each day. It does not render general nursing care. Its personnel must be in an on-call status regularly for night, week-end, and emergency surgery. Its needs, disciplines, contacts, and work requirements are so radically different that they are not easily integrated with general nursing.

The continuing insistence of some hospitals that such unrelated functions as the operating room and general nursing be meshed together by sheer force will no doubt result in a lower standard of patient care.

New Trends in Surgery

A panel discussion on new trends in various fields of surgery was held at the A.O.R.N. convention in St. Louis. Discussions by two of the panelists follow. Two more panel discussions will be found on page 78.

Pediatric Surgery

● The newest, most dramatic trends in pediatric surgery are above the diaphragm. But there is a new trend below the diaphragm which is my particular field. I think I can summarize that trend by saying that abdominal surgeons have now adopted a more aggressive attitude toward surgical intervention in infants, even in the newborn and in prematures, with the idea of saving life and achieving many other therapeutic benefits which have not been available in the past.

This trend is due to many things. One of them is the explosion of several myths—that a baby can't stand an operation, that the psychic trauma for a child is too great and may exert a bad influence in later life, or that the baby lacks resistance. These myths, I think, are based largely upon sentimentality.

Actually, even premature babies are endowed by God with a tremendous vitality so that they can stand extensive abdominal procedures. So the mortality now is relatively low, and the risk is scarcely less than in later life. But this recognition that one can save life by adopting a more aggressive attitude has also been due to the fact that many technical difficulties have been overcome.

Some technical difficulties are apparent only to those not accustomed or trained to operate on newborn or

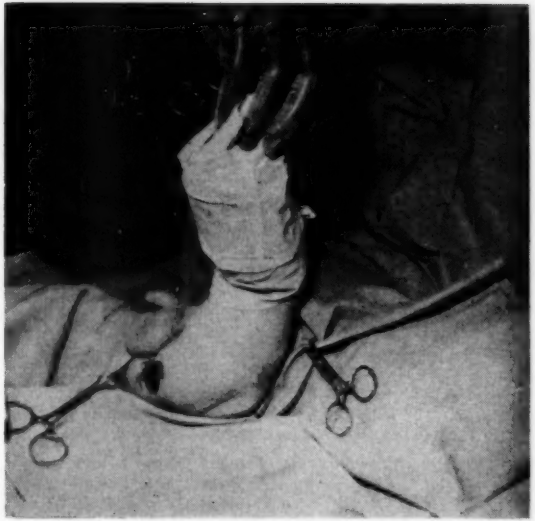
small babies; others are real but are now being overcome.

Among the technical advances are certain pre-operative preparations or procedures, one of which is prompt uses of gastric gavage. Babies are so prone to aspirate their gastric contents, even without any particular premonitory signs, that it is very important to keep the stomach empty by means of adequate gastric gavage, not only before but during and after operation.

Chemotherapy when used critically has also played a very important part. A knowledge of blood, food and fluid needs in the infant is essential, so much so that it is almost routine now in all significant abdominal operations for a cut-down to be instituted before the patient reaches the operating room or before the anesthetic is started.

Years ago I used to have a good deal of difficulty getting instruments that were small enough for these little babies. In spite of all my efforts in setting up a special pediatric tray, I still got Kelly clamps just about as large as the patient. The suture material was a difficult problem. We used to borrow the iris needles and fine silk from the ophthalmic surgeons, but since cardiovascular surgery has developed we use the arterial silk which I find very effective.

During the course of the operation we have learned also that one must be bold and aggressive. For example, it is essential in many cases to completely eviscerate the entire contents of the abdomen in order to find and correct the nature of the lesion responsible for the obstruction. Such exposure also permits more



Above: An abdominal perineal operation for a high-lying imperforate anus. This operation was done within 24 hours of birth, and the entire defect was corrected at one sitting. There has been no mortality in the last 12 cases in which this procedure has been done. Cut down is on either leg. The skin can be sterilized down to the toes. The perineum and the abdomen are prepared at the same time.

Above: Through an abdominal incision, the colon is dissected out, its communication with the bladder or the vagina is identified and severed, and then the colon is brought down into the perineum and sutured. Often by the time the patient gets back to the ward he has a normal meconium stool.

definitive procedures, aided of course by excellent anesthesia.

These new trends can best be exemplified by describing a few examples. Many years ago many babies died of general peritonitis due to gastrointestinal perforations, largely because it was very difficult to make a diagnosis. We now recognize that perforations may occur in infancy and the newborn, with very few clinical manifestations, and that prompt operation will save many of these lives. Acute appendicitis is a common cause, which I mention only because there is still a tendency to believe that it can be treated medically.

Sir William Osler many years ago said, "There is no medical treatment for acute appendicitis," and that is particularly important in children in whom the signs and symptoms may be atypical and perforation and general peritonitis may lead rapidly to a fatality.

With the aid of chemotherapy the operation has become much safer. I don't believe we've lost a single case of acute appendicitis in the last five or 10 years, whereas previously the mortality in the perforated cases with peritonitis was as high as 30 and 40 percent.

Inguinal hernia is another common condition in which a more aggressive attitude has resulted in the saving of life and the relief of much disability. It is safer now to operate on a baby than it is for the baby to have the risk of strangulation. We no longer wait until the child is five or six years or even one year of age; a hernia can be easily and safely treated in infancy. In fact, there are many reasons to believe that it is better to operate on hernia in infancy than later. Certainly the use of trusses in children has no place at all.

We have had no deaths from hernia operation in infancy except in the few cases in which strangulation has occurred.

There are other examples. One is intestinal obstructions at birth, particularly in the premature. We have learned that procrastination really leads to disaster in many cases, and that prompt operation is urgent and often rewarding.—**Robert Elman, M.D.**, professor of clinical surgery, Washington University School of Medicine, St. Louis.

Cardiovascular Surgery

In considering developments in cardiovascular surgery during the past 15 years, one might itemize a large number of operations and discuss progress related to each operation. However, we shall confine our attention to three main aspects of the subject: hypothermia, a physiological alteration in the patient; the heart-lung machine, a physiological substitute for the heart and lungs, and grafts of various sorts, anatomical substitutes for the parts of the cardiovascular system.

Hypothermia literally means low temperature. In modern practice it means the reduction of the patient's general body temperature by a significant amount. The normal body temperature is in the neighborhood of 98.6 Fahrenheit. Strictly speaking, if we reduce our temperature to 97, that constitutes hypothermia. This technic of lowering the body temperature slightly has been and continues to be useful. However, hypothermia today usually means temperature below 90° F. down to levels as low as 68 or 70° F. and sometimes even lower.

Such a degree of temperature reduction brings up entirely different problems than the slight reductions. The lesser degrees of temperature reduction in the patient, down to levels of 90 or above, are useful in preventing the opposite trend of the patient's temperature during the hot weather such as we experience in St. Louis during the summer. In order to prevent the patient's temperature from rising unduly, we may place him on an ice-water mattress which keeps his temperature at normal levels or even several degrees below.

The modern interest in hypothermia was initiated by Bigelow, a Toronto surgeon and physiologist, who reported several years ago that he had reduced the body temperature in dogs to between 68 and 78° F. (20-25° C). With body temperature at this level, it had been possible to stop the heart action of these dogs for 15 minutes with subsequent complete recovery of the animals. These animals recovered because the lowered temperature diminished the oxygen needs of their brain and other organs in such a pronounced fashion that these organs were not irretrievably damaged by the cessation of heart action and the absence of oxygenated blood during the period of cardiac arrest.

This report of Bigelow set off a wave of investigation which is still going on in an attempt to determine the fundamental physiology of hypothermia.

In his initial report, Bigelow also commented on the possible bad effects of this technic. One of the most obvious was ventricular fibrillation or incoordinated beats of the heart so that the heart, while active, is not propelling blood forward through the circulatory system.

When one gets the patient's general body temperature down to levels of about 80° F., the likelihood of fibrillation is considerable; if the temperature is carried down into the sixties the likelihood is extremely great, particularly if the heart is being manipulated at the same time.

When fibrillation of the ventricles occurs during cardiovascular or other surgery in the heart at normal temperature, it may be a relatively simple matter in some patients to revert this abnormal rhythm to normal. This can be accomplished by periodic compression of the heart so that the pumping action is maintained artificially and the heart may then return to its normal rhythm. In most cases, however, it is necessary to apply electrical shock to the heart, to stop completely the abnormal muscular activity. After the heart has been reduced to a complete standstill, compression by the hand in a rhythmic fashion usually will return the normal beat of the heart within a relatively short time.

This correction of ventricular fibrillation is a relatively easy matter in the warm heart which has no inherent abnormalities. On the other hand, in abnormal hearts and particularly in hearts which have been cooled to a pronounced degree, the restoration of a normal co-ordinated beat may be very difficult.

Hypothermia has been used extensively in many operating rooms, and there are various ways of accomplishing it. In Bigelow's original work, he employed a special blanket through which a coolant was circulated which lowered the patient's skin temperature first. Gradually the temperature of the entire body dropped. After the patient was removed from the cooling blanket, his temperature tended to go down a little farther. In using this technic, if the cooling is stopped at 75 or 80° F., the temperature may be expected to go several degrees lower during the ensuing half hour.

With every degree Centigrade that the body temperature is lowered, the basal metabolic rate drops about 5 percent. Consequently, if someone's temperature is lowered 10 degrees Centigrade, his basal metabolic rate or oxygen needs will be dropped about 50 percent.

It is known that if the heart stops for four minutes, more or less, and oxygenated blood is not pumped to the brain at normal temperatures, the patient will suffer irreparable damage. This interval can be considerably prolonged without such damage if the patient's general temperature is lowered. The heart action and respirations slow down until respiration finally stops and has to be maintained artificially. As one rewarms the patient, spontaneous respirations are again resumed.

In ordinary laboratory rats cooled down to 5° C. (approximately the temperature of a home refrigerator) the heart can be stopped for 30 minutes, and the rats probably will recover. If the heart is stopped for an hour to three hours, about half the rats will recover. If it is arrested longer than three hours none will recover. These results cannot be transferred to man, but they do give us additional information about the mechanism by which hypothermia gives protection in certain animals.

In addition to using cooling blankets, one may cool the patient by placing him on ice-water mattresses, on

ice bags, and even in a bathtub of ice water in the operating room. I am sure that operating room supervisors generally would consider bathtubs in the operating room as undesirable. However, they are used and function efficiently even if they are somewhat messy.

HEART-LUNG MACHINES

Work with heart-lung machines will always be associated with John Gibbon of Philadelphia. For approxiately 20 years he has expended tremendous effort and very large sums of money to develop a machine which would substitute for the pumping action of the heart and for the oxygenating function of the lungs. To provide a pump is relatively easy, and to prevent the clotting of blood in the apparatus is also not unduly difficult. However, artificial oxygenation of the blood is more troublesome. Some of the practical problems concern the danger of hemolysis or breaking down of the red cells, the risk of infection (which is no longer a problem when one can sterilize reliably all parts of the apparatus) and, finally, the disturbances in coagulability of the blood, which are brought about in some obscure way by passage through this machinery.

There is a deliberate attempt to render the blood incoagulable in order to prevent it from clotting in the apparatus. However, after the effect of heparin has been reversed by appropriate medication and the patient has begun to recover successfully from his operation carried out with the aid of the heart-lung machine, a bleeding tendency may develop which cannot be controlled, and in some instances death has resulted.

Work is continuing on the solution of these and other problems, such as the prevention of foaming of the blood, the substitution for the lungs alone, the substitution for the right or left side of the heart alone, and the studies on relation between bacterial contamination and the use of these devices.

Most operating room nurses are familiar with the success achieved by Minnesota surgeons with use of a donor who oxygenates the blood for the patient while the heart and lungs are removed from effective circulation so that the heart may be opened and repaired. In this technic, the healthy adult donor, who is usually the patient's mother or father, is anesthetized in the operating room alongside the patient, and the unoxygenated blood is drawn from the patient with a pump passed into the venous system of the donor and oxygenated by the donor. Then it is drawn off from the donor's arteries and pumped back into the patient's arteries. The patient in effect gets blood which is a mixture of his own blood and the donor's blood, all of which is being oxygenated by the donor.

The risk to the donor has raised some questions. Dr. Varco, who has been associated with Dr. Lillehei and others in this work at Minnesota has stated that one should not consider it unusual if a mother or father undergoes some risk to save the life of a child. Such a risk is gladly assumed, with full knowledge by the parent, when the mother originally has the child, as well as in certain other circumstances. There have been no deaths among any of the donors used in employing this technic.

GRAFTS

By grafts we ordinarily mean blood vessel grafts. In blood vessel grafting we take an aorta, let us say, or a femoral artery and replace it with the aorta or femoral artery of another person. This work, done by Carrel at the turn of the century, was revived and put on a solid foundation by the work of Dr. Robert Gross and his associates. In their original work the grafts were taken from donors under very careful bacteriological conditions and were preserved in nutrient media designed to maintain their viability for 30 or 40 days. In the beginning it was believed that these grafts should be viable, but it has since been learned that so-called viability is not necessary, since one may kill the graft by formalin, by sterilizing agents, and in various other ways, and still have it function effectively as a conduit for blood.

One may remove a blood vessel which is to be used as a graft under either sterile or unsterile conditions. If it is removed under sterile conditions, an attempt is made to keep it that way. If it is taken under unsterile conditions it is sterilized by radiation or by various other agents, such as ethylene oxide or betapropiolactone. Some have used simple 70 percent alcohol.

The graft may be preserved by freezing rather than by keeping it in nutrient media. When one freezes the graft very rapidly to avoid damaging it, he may then dry it by sucking off all the moisture in a vacuum. This freeze-dried graft may then be kept in a sealed tube for a long period of time, up to several years. When the graft is needed, it is removed in its dry state and dropped into saline solution for perhaps half an hour. It is then pliable, flexible, and very similar to the blood vessel in its original state.

Starting from the premise that one might use a blood vessel which was completely inert and nonviable since it had been sterilized and dried, the idea was gradually developed of employing something completely inert, such as cloth. Dr. Blakemore employed cloth made of vinyon-N which ordinarily permitted oozing of a small amount of blood through the pores, but this soon stopped and the cloth tube then functioned as a conduit, which is about all that the preserved blood vessels did. The blood vessels have the advantage of elasticity, but this does not appear to be particularly important when only a small segment of the vessel is replaced.

From the use of vinyon we have progressed to nylon, orlon, dacron, and a variety of other materials, so that surgeons now have available tubes of cloth which can be sewed on the spot by hand or by machine or woven in a special fashion to present seams and wrinkles. These inert materials and various plastic substitutes can be used also in replacing defects in the walls of the heart and various other organs, but the exact place of such prostheses is still being evaluated.

C. Rollins Hanlon, M.D., Professor of Surgery, St. Louis University School of Medicine.

Question Box

Each month questions pertaining to O. R. problems and technics will be answered by Dr. Carl W. Walter, nationally known for his operating room technic courses and as the author of "Aseptic Treatment of Wounds" (MacMillan). Questions should be addressed care of the O. R. Editor, Hospital Topics.

***Q.** We sterilize our syringes and needles in a steam autoclave. Is it necessary to rinse them in ether, after washing with detergent and rinsing in distilled water, before autoclaving?*

We keep our parenteral solutions in a place where the temperature drops to below zero. Is this dangerous?

A. Ether contributes nothing to the care of syringes. Syringes should be washed in a hot detergent solution, rinsed well, and sterilized in saturated steam at 250° F. for 30 minutes.

The only danger in exposing the parenteral solutions to sub-zero weather is that of the glass bottle breaking.

***Q.** We would like to have some information regarding the iodoform gauze. How long do you consider it sterile after it has been opened and part of the gauze removed from the bottle under sterile technic? Any information as to the use, strength, and length of time held after opening will be greatly appreciated.*

A. "Iodoform is a lemon-yellow powder with a characteristic disagreeable and persistent odor. The compound is practically insoluble in water and it is difficult to estimate its bactericidal potency. An aqueous suspension of the drug is not germicidal and is only slightly antiseptic. When applied to tissues, the compound slowly releases elemental iodine and this is the basis for its mild antibacterial action. Iodoform was formerly used rather extensively for dressing wounds, but is rather ineffective and is now seldom employed"*

If the gauze is handled with care and personnel avoid talking across the opened container, it should be safe to use until the supply is exhausted. Ideally, every patient should have individually wrapped and sterilized dressing material and stock supplies removed from the hospital.

**Goodman, Louis and Gilman, Alfred:* The Pharmacological Basis of Therapeutics, *The MacMillan Company, 1941, page 845.*

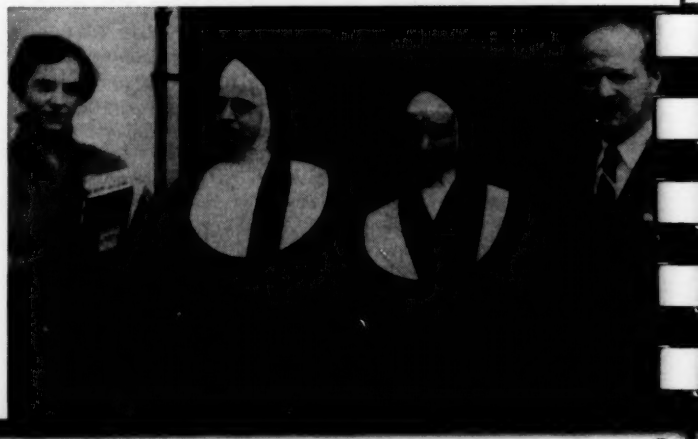
Between Classes at San

Above: Ann Ivarson, Lottie P. Felkner, ORS, and Joy M. Olsen, all of Salt Lake County Hospital, Salt Lake City, Utah; and Dorothy Cunningham, ORS, Holy Cross Hospital, Salt Lake City.

● A five-day course in operating room technic was given recently by Carl W. Walter, M.D., of the Peter Bent Brigham Hospital surgical staff, Boston, at St. Mary's College of Nursing, San Francisco.

The course was sponsored by Stanford University School of Medicine and San Francisco State College.

Below: (l. to r.): Mary C. Bortz, ORS, Kansas University Medical Center, Kansas City, Kans.; Sister M. Augustine, ORS, Trinity Hospital, Arcata, Calif.; Sister M. Loyola, ORS, St. Joseph's Hospital, Eureka, Calif.; and Dr. Walter.



Francisco O. R. Institute

Above: Dorothy Wysocki, R.N. (l.) assistant to Dr. Walter, Peter Bent Brigham Hospital, Boston; and Mary G. Murphy, CSR supervisor, St. Mary's Hospital, San Francisco.

Below: Capt. Barbara J. Nichols, ORS, US Army Hospital, Fort Lawton, Wash.; Lt. Phyllis Taylor, CSR supervisor, US Naval Hospital, Oakland, Calif.; Capt. Rita Conners, ORS, George Air Force Base, Calif.; and Maj. Elizabeth Hagarty, CSR supervisor, US Army Hospital, Fort Ord, Calif.

New Trends in Surgery

(Conclusion)

Neuro-Surgery

Neurological surgery must be considered primarily surgery, with the aspect of neuro attached to it, rather than neurology with the aspect of surgery. That means that it is fundamentally still a surgical specialty.

To understand some of the newer trends, one has to view this specialty from its historical background.

The attack on the brain and the nervous system in the past was rather haphazard. Some of the first tumors were removed simply to make the contour of the head symmetrical. Whatever beneficial result might have accrued to the patient was simply fortuitous and accidental. It required a "new trend", i.e., the development of such a technic as "cerebral localization" — the composite study of clinical material in which patients with lesions of the brain, time after time, evidenced a certain clinical picture. This was correlated with the pathological findings. One could then assume, for example, that if a patient had a right hemiplegia, could not speak, and he was right-handed, his lesion would be in the left temporal lobe.

At the same time (just about the turn of the century) advances, particularly in England in the laboratories of Dr. Sherrington, in stimulation of the brain electrically, gave information that allowed one to assume that in the normal functioning brain certain areas had predominantly certain functions, such as smell or vision, so that both from a clinical and physiological study one got a better idea of the mechanisms of the brain and how they worked.

Still the attack on the brain for lesions fell mostly

Below: Members of the panel on "New Trends in Surgery," were: James Mudd, M.D., associate professor of surgery, St. Louis University School of Medicine; Hayward Post, M.D., former professor of ophthalmology, Washington University School of Medicine, St. Louis; C. Rollins Hamlon, M.D., professor of surgery, St. Louis University School of Medicine; Robert Elman, M. D., professor of clinical surgery, Washington University School of Medicine; Alfred Sherman, M.D., assistant professor of obstetrics and gynecology, Washington University School of Medicine; Edmond Smolik, M.D., associate professor of neurological surgery, St. Louis University School of Medicine; and William Sinkler, M. D., medical director, Homer G. Phillips Hospital, St. Louis.

in the province of the skilled general surgeon, with the aid of the ancillary sciences then developing—namely, neurology and ophthalmology. A change came principally under the great dominant work of Dr. Harvey Cushing, who felt that there should be one individual who would assume the sum total responsibility of the patient. He would have a knowledge of neurology and surgery, and some knowledge of ophthalmology and neuro-pathology, and would then make the diagnosis and tackle the problem all on his own responsibility.

Then of course there were terrible problems. A patient might act as though he had a frontal lobe tumor and the frontal area of the brain would be explored, unfortunately no tumor would be found, and the patient would die. Autopsy would reveal a cerebellar tumor.

It was about 1918 that Dr. Walter Dandy at Johns Hopkins gave us the one great single step which even today, to my way of thinking, is one of the *sine quanons* in diagnostic procedures—the introduction of air into the ventricles of the brain. Utilizing these methods of pneumoencephalography and ventriculography, diagnosis was much more accurate in identifying space lesions of the brain.

From 1918 to approximately 1940, the problems were those of technic. The terrible problems that must have the groundwork of his personality—namely, the uncontrollable hemorrhage—was tackled by Dr. Cushing, who gave us silver clips; who gave us the Bovie instrument and electro-surgery.

It was the use of this instrument and the development of suction which allowed successful removal of brain tumors so that the mortality slipped steadily downward. In any well-ordained neuro-surgical clinic there is team play—not only in the operating room, because one could just as well spend his time in the operating room successfully and then send the patient quickly for a consultation with the pathologist—but also in the coordinated work of the ward, preoperatively and postoperatively.

In this sphere, I feel that nurses play almost a greater part than the neurological surgeon himself. It's the nursing care that saves the patient, in my opinion.

Concurrently there were developments in anesthesia which allowed much bolder attacks on the integrity of the brain. They allowed much more daring procedures, because now hemorrhage could be controlled; the patient could be maintained oxygenated, and blood volume maintained by the use of transfusion, which even in my intern days was still a rather heroic procedure with the old Vincent tube.

One of the most triumphant aspects of neurological surgery has been the surgery of the vascular aspect of the brain. In my house officership in neuro-surgery we used to see the patient who has subarachnoid hemorrhage, a young individual with no stigma of hypertension, or arteriosclerosis, who suddenly blew a hole in a blood vessel in his brain. We did two things: we prayed, and we let him alone. And one of two things

happened: he lived, or he died. If he lived, he had another chance to die.

About 1935, in Lisbon, Portugal, Dr. Moniz, he who developed prefrontal lobotomy, very daringly introduced an opaque medium into the vascular system. With this contrast medium he visualized the circulation.

With this method, aneurysm, a congenital saccular development of the vessels of the brain, particularly in that area known as the "Circle of Willis" was demonstrated. In this area these congenital sacculations would blow out under stress and strain, sometimes with no more cause than a friendly slap on the back, resulting in unconsciousness because of a blood vessel break in the brain. Or, a tuba player in an orchestra might blow out an aneurysm.

With visualization of this vascular tree the neurological surgeon began to attack the problem, and again was forwarded by the pioneer efforts of Dandy. Since then this problem has been taken up by all neurological surgeons throughout the world.

There are two schools of thought. Some neurosurgeons feel that a direct attack on the aneurysm in the brain is the method of choice. Other neurosurgeons prefer to cut off the blood flow in the neck by ligature of the carotid artery. There is experimental evidence for the validity of such an approach particularly coming from the laboratory studies under Dr. Sweet of Harvard, Dr. German at Yale, and Dr. Barnes Woodall at Duke University, who ingeniously have measured the blood flow and the small vessels of the brain under various conditions of ligature in the neck and have found that the gradient of pressure does drop.

Now of course there are many aspects of this, that each case presents a problem in itself; thus a lesion on the left side in a right-handed person is an entirely different thing than the same lesion on the right side and may indicate what heroic procedure may or may not be entertained by the neurological surgeon.

This has had concomitant stimulation on the types of media that should be introduced into the blood flow, the equipment that's used by the radiologist. It's really a great opportunity for you to stimulate your x-ray departments to keep along with modern trends and develop more expert methods of shooting films, because now we want rapid cassette changes which are necessary to demonstrate these things properly, and life saving.

In 1940 the mortality of brain abscess was miserably high. In fact, when Dr. James H. Mudd and his various colleagues called us in to see a metastatic brain abscess, we dreaded it, because we were merely the prelude to the autopsy room. But because our technic was relatively conservative, it consisted of tapping. At times, if there was evidence of a chronic abscess, such things as marsupializing the brain abscess, or, under certain conditions, the method that was advocated by Clovis Vincent of Paris of taking out the abscess enmasse, was effective in restricted numbers. But with the advent of antibiotics, the intermediate step, and chemotherapy, this has changed. For example, in the last eight brain abscesses I have had I have applied a resolute radical approach of sucking them out just as one does a glioma of the brain. They have all survived, with tightly closed

dura. One of them was an actinomycotic abscess. Heretofore such abscesses have been universally fatal.

I want to consider briefly the field of function of the front lobes of the brain. Perhaps no single disease affects humanity today more than mental disease. The number of hospital beds is acutely deficient. The number of people walking the streets today who should be in mental institutions, or who are part in and out, is fantastically high.

The flux of national and international events has caused tensions that are affecting everybody. Hardly anyone has not had some stigma of this pressure. Now this has produced dramatic organic attempts at aid, by the psychiatrist, and in this area the neurological surgeon has appeared.

Of course you all know the story to a great extent of psycho-surgery which is an attempt at taking an intact brain and produce damage in order to effect a good result. Restriction of the damage to an intact brain allowed modifications of this operation which have been steadily carried out. Together with Drs. Hofstatter and Busch we have been emphasizing the orbital surface of the brain as being predominantly the seat of emotional disturbance. We have restricted the operation to this area with great success. More information has come from studies at Columbia under Dr. Larry Poole, in which the cortex actually has been removed—a so-called topectomy; Dr. Spiegel in Philadelphia has taken a Horsely-Clarke stereotaxic instrument—a very delicate, highly calibrated instrument, so that, through openings in the skull, minute areas can be destroyed, and has done thalamotony. All these technics have given important information about functions of the emotional life.

Very recently the work of Dr. Peter Lindstrom, in which ultrasonic waves have been shot at the frontal lobes has aroused interest. He has produced varying degrees of edema to actual necrosis. This procedure, which seems promising, is still being assessed.

With respect to pain, which we're all subject and heir to, a very complex state of affairs exists. Here the neurological surgeon has made great advances in its treatment. He has sectioned not only the peripheral nerve pathway, but varying areas in the spinal cord, and actually in the brain stem (so-called chordotomy and tractotomy). Indeed, section has been carried into the brain itself. Resections of the sensory cortex and frontal loconomy have been done to free the patient of pain.—**Edmond Smolik, M.D.**, associate professor of neurological surgery, Washington University School of Medicine, St. Louis.

Ophthalmic Surgery

● What is new in ophthalmic surgery? Perhaps the most striking trend is the increasing use of various measures to produce coagulation of the retina and choroid. This procedure is employed most frequently in cases of retinal detachment, but is also used to reduce intraocular tension in selected cases of glaucoma.

Coagulation may be induced by the application of direct heat to the scleral surface, or, much more commonly, by penetrating or nonpenetrating diathermy.

The real beginning of such treatment for detach-

ment of the retina, although previously employed sporadically by Verhoeff and a few others, followed the dramatic announcement by Gouin, at the International Congress of Ophthalmology in 1920, of his remarkable success in securing reattachment following the direct application of the galvanocautery to the tear, or tears, in the retina, now recognized to be responsible for the lesion.

In 1932, Weve suggested the use of diathermy for the same purpose. Because of its greater simplicity and high percentage of successful results, this method rapidly superseded all others, until today it is in common use in every eye clinic of any importance all over the world.

More recently, coagulation by diathermy, as a means of destroying parts of the ciliary body and thus reducing its activity in the production of the intraocular fluids, has become a noticeable trend in the surgical treatment of glaucoma. An understanding of the rationale for this procedure received a great stimulus with the introduction of the electronic tonometer a few years ago. By the use of this instrument with proper recording devices, it has become possible to determine whether the hypertension in the glaucomatous eye is the result of increased production of intraocular fluid, or of obstruction to outflow of fluid through the usual channels. If the production of an abnormal amount of fluid is found to be the responsible factor, coagulation of portions of the ciliary body by diathermy is now accepted as the logical procedure.

Recently, other ingenious methods to produce sharply localized chorioretinal coagulation have been proposed, but have not as yet received general recognition. One of these was suggested by the well-known effect upon the macula resulting from indiscrete observation of eclipses of the sun, when proper protective glasses were not worn.

With injuries so produced in mind, Schweckerath, of Bonn, constructed an apparatus resembling a huge ophthalmoscope, using a special arc light as a source of illumination. The lesion is first localized by observation through this apparatus under subdued illumination. Then, without disturbing the position of the instrument, the full force of the arc is turned on, resulting in coagulation of the observed area. This takes place in one-fifth of a second if the lesion is near the macula, while one second is required if it is situated in the extreme periphery.

A second method, especially applicable for the treatment of the delicate and relatively inaccessible macula, has been suggested by Angelos Dellaporta, from the Eye Bank and Research Laboratory of the University of Buffalo Medical School. A long insulated diathermy needle is introduced into the eyeball at the ora serrata —that is, about 7 mm. from the corneal limbus—and then passed across the vitreous into the choroid and sclera underlying the lesion. When properly located, as seen by direct ophthalmoscopic observation, the current is turned on and coagulation produced in the desired area.

With either method, much less damage should result than with searching for the retinal tear from outside the globe in this region.

Scleral resection, either penetrating or laminated, as an adjunct to diathermy in the treatment of detachment, is growing in favor. Dr. Schepens, of the Massachusetts Eye and Ear Infirmary, who is devoting his entire energy to this type of surgery, has recently stated his conviction that this procedure should be done, along with diathermy, in all operations for retinal separation. A section of sclera, whether penetrating or laminated—with only the outer two-thirds removed, from 3 to 6 mm. wide—is dissected away concentric with and about 8 mm. from the corneal limbus. As fast as the strip of sclera is removed, pre-placed mattress sutures of chronic catgut are tied, one by one. The result achieved is reduction in the size of the scleral envelope, thereby permitting the retina, which is frequently contracted, to fall back into place against it. The laminated section is far safer and seems to be almost equally as efficacious as the through-and-through procedure.

The operation of corneal transplantation may well be included in recent developments in ophthalmic surgery. Transplants may be total, including almost the entire cornea, or may include only a small circular or square area in the central portion. Either may be penetrating or nonpenetrating. The latter is applicable in those cases in which the opacity involves chiefly the outer layers. The best results are obtained when the transplant is contiguous to clear corneal tissue, at least in part.

The partially buried orbital implant, in various forms and materials, achieved great popularity a few years ago. In some cases, the plastic and tantalum mesh substitutes for the enucleated eyeball appeared well tolerated, becoming firmly adherent to the recti muscles sutured to them at the time of operation. By them there was certainly produced a very considerably increased motility of the plastic artificial eyes, articulated with them by means of pegs of one shape or another. However, in my experience these operations generally have proven unsatisfactory in the long run. The implants have tended to slough out and to become hopelessly infected, at times even ill-smelling. In many cases the attachment has become so attenuated that the unfortunate wearers have been required to refrain from such sports as swimming, diving, and other forms of violent exercise. They are, therefore, less used at present than formerly.

Instead, some form of buried implant has been substituted. Some of these are the old familiar globes of various materials; others are modified in shape so that the recti can be sutured to them to increase motility and also to prevent their becoming displaced in the muscle cone. Generally speaking, some form of suturing the recti muscles, either to the implant or to one another, has superseded the old method of allowing each to seek its own resting place.

No discussion of modern ocular surgery would be complete without mention of the developments taking place in the operation for the removal of a cataract. The use of corneoscleral sutures is an old story. So are the various methods of intracapsular extraction through a round pupil, with one or more minute basal iridoto-

mies. By such measures, the final result not only secures excellent vision and a minimum amount of photophobia, since the sphincter still functions, but cosmetically results in an eye little changed from its former appearance. Perhaps the growing use of the erysiphake for rupture of the zonule and delivery of the lens in its capsule should be noted.

But the most recent development which is undergoing trial at the present time in some ways reverses this general trend. The Ridley operation requires the removal of the lens nucleus by the old extracapsular method; then, into the capsule thus vacated is slipped an acrylic lens of a size and shape similar to the nucleus just removed. This operation has been performed in slightly more than 100 cases, with remarkably good results in some and with serious consequences in surprisingly few. Considerable time must elapse, however, before the end results of the procedure can be evaluated.

With the introduction of Pentothal sodium and tracheal insufflation, along with curare, in certain cases, such satisfactory general anesthesia has been possible, given in such a way as not to interfere with the field of operation, that its use has been slowly growing in popularity. Even postoperative vomiting appears to be coming under control through the use of the remarkable new sedative, Thorazine, which may be used both preoperatively and postoperatively for this purpose.

Few of the modern technics would have been possible had not great strides been made in the prevention of infection. It is a far call from the blackened fingernails resulting from the use of potassium permanganate and silver salts by the surgeons and nurses of my early days to the conditions of today. Hexachlorophene, or G-11, has revolutionized the preparation of the hands, and is far more efficacious than any of the procedures followed in former years, while various chemical solutions, dry heat, ultra-violet radiation, the recognition of dust-borne infection, and the modern autoclave have been equally effective in decontamination of wounds, instruments, towels, and other objects.

Finally, the demonstration and almost universal acceptance of the fact that the use of rubber gloves by those performing the extremely delicate surgery of the eye is not only practicable, but highly desirable, has been an important step in the reduction of infection from the two percent considered reasonable 20 years ago to the 0.1 percent occurrence found in the statistics of many of the best services today. Indeed, the complicated procedures, requiring large numbers of instruments, which are the rule in modern ophthalmic surgery, would be impossible without modern technics for the maintenance of sterility. Modern methods of sterilization and modern technics go hand in hand in their contribution to the march of progress in this and all other fields of surgery.—**Hayward Post, M.D.**, former professor of ophthalmology, Washington University School of Medicine, St. Louis.

Gynecologic Surgery

● Medical discoveries and developments for the most part have not been isolated in their benefits. Once suc-

cessfully evaluated and adopted, they have been responsible for improving the results, ameliorating the difficulties, and reorienting the trends of all specialties. The introduction of antibiotics, the establishment of blood banks and blood transfusion technics, and the integration of recent accomplishments in anesthesia are a few examples of such progress. To these I would like to add a fourth: the operating room nursing team geared to present day surgery and their sister companions, the recovery room nurses.

Gynecology has also fallen heir to the fringe benefits of these developments and has taken full advantage of them. A comparative study of the past and present gynecology surgical schedule will demonstrate two main changes. The pelvis is just as prone to infections as it has always been. However, the need of surgical interference for these inflammatory situations such as salpingitis and salpingo-oophoritis has virtually disappeared.

During this same time many of the surgical dreads have been eliminated, and so operative risks have been substantially decreased. Consequently, surgical procedures such as vaginal hysterectomies and A & P repairs are available to many previously considered poor risk patients, who can now avoid the discomforts and insufficiencies of the numerous and sundry pessaries to which they were otherwise relegated.

This new-found safety has influenced gynecologists to attempt new procedures and to re-explore some of the old ones. It has permitted some operations to become more extensive—for instance, total versus supracervical hysterectomies—and has allowed the adoption of ingenious new extensive operations, such as pelvic eviscerations and Wertheim procedures.

However, in the past few years gynecology has made two specific immeasurable strides in progress—both in cancer control. Gynecologists have directed much attention toward the diagnosis and treatment of cervical cancer before it is invasive and toward technics to more adequately control the invasive cancer once it has taken a foothold.

In spite of the tremendous research programs being performed, the cause and prevention of cervical cancer remains unknown. The recognition, however, that cancer of the cervix can be detected in its pre-invasive form is a momentous discovery. The acceptance that one can diagnose cancer of the cervix in its in-situ form is of extreme importance. It is not difficult to realize the significance of finding cancer before it becomes invasive and follows its usually malignant course.

This fact has caused a new trend in gynecological surgery. The extirpation of a malignant lesion when it is in a state of benignity now becomes possible. In addition, localization of the lesion at this stage allows its removal by a rather nonextensive procedure which is also less mutilating and less consequential, and, of importance to the younger woman, preserves ovarian function, even allowing childbearing. With this trend has come a wealth of investigative work in an attempt to facilitate its discovery and diagnosis. The use of vaginal smears and the development of simple biopsy technics have become available to every physician. The results of these tests and treatments have now been

successfully evaluated and are well documented.

The one drawback to this situation, which may prevent the detection of cancer at this stage, is that the woman must present herself for examination. Cancer of the cervix could become an insignificant disease in our society if the women were aware of it and co-operated. Such co-operation involves the routine six to 12-month vaginal check by a doctor. All women must be educated that this disease can be treated almost assuredly with 100 percent cure, if they will present themselves for vaginal examination and are diagnosed in the early stage.

Gynecologists have long been concerned with the treatment of the invasive cervical cancer. Trends in treatment have zigzagged over the years. Before the discovery that radiation could be cancericidal, many surgical procedures were described and utilized in their treatment. The radical hysterectomy, popularly known as the Wertheim hysterectomy, and the Schauta, or radical vaginal hysterectomy, were the most common procedures. They then had an extremely high mortality and morbidity rate. This fact, plus the introduction of radium and x-ray for the treatment of cervical cancer, decidedly changed the trend away from surgery toward radiation. For several years the treatment over the country was almost exclusively that of radiation.

When it was realized that radiation was not the complete answer, there were adventures into combined procedures. In the period just beyond most recent years, the therapy consisted of a most varied collection of approaches utilizing different radiation and surgical technics in a number of varied combinations. The answer to the question why this was so is not difficult.

As the popularity for the intracavitary use of radium increased and radiation physics improved, the treatment became safe and somewhat standardized. It soon became obvious that radium therapy as we know it today was extremely efficient for eradicating the disease at the primary site—in the cervix itself. However, once the tumor spread beyond the cervix, the results were poor.

Cancer spreading from the cervix will grow laterally. It will invade the base of the parametria and spread along in the direction of the blood vessels to the lateral pelvic walls and will become located in the lymph nodes overlying the iliac and hypogastric vessels in the lateral portion of the pelvis. The lethal rays emanating from the centrally located radium sources are of sufficient intensity to kill cancer in the neighborhood of the cervix. However, as they move laterally, they rapidly lose their intensity and become ineffective against the cancer in these lateral regions. The cause of the failures is thus easily explained. The remedy is not so simple. The attempts to correct this inefficiency form one of the major trends of present gynecology.

The approach has been both varied and numerous. The more surgically-minded therapists have directed their attention toward excisional removal of these cancer-contaminated and potentially cancer-contaminated tissues. The more familiar procedures attempting this are the pelvic lymph node dissections, either the transperitoneal Taussig type or the extraperitoneal Taylor Nathanson type. Also included are the combined Wertheim and complete pelvic lymphadentectomy procedures popularized most recently by Dr. Meigs. Those even more radically inclined have performed complete

pelvic eviscerations and lymph node dissections such as have been advocated by Dr. Brunschwig. Hand in glove with these have come the ingenious surgical technics for ureteral transplantations and bladder substitutions.

Others have directed their concerted efforts to increase the radiation dose to these areas. External x-ray therapy has been carried to the utmost tolerances of the normal structures through which they are directed. Also with this in mind, magnificent machines have been devised and built to deliver extremely powerful x-rays. Some with which you may be familiar are the Van De Graf units, the cobalt bombs, the betatrons, and now in the immediate future the linear accelerator units. They are all being used in order to deliver more effective cancericidal doses of radiation to the lymph node bearing areas.

The recent availability of radioactive isotopes, a by-product of the atomic bomb, allows the possibility of still another technic to accomplish this same tumor radiation in the lateral pelvis. This is the insertion or injection of radioactive isotopic substances directly into these tumor-bearing areas. Radioactive cobalt threads have been used in this way. Another technic with which I am more familiar involves the parametrial injection of radioactive colloidal gold.

It is too early to be sure what the ultimate results will be, but results to date have been good and remarkably encouraging.—**Alfred Sherman, M.D.**, assistant professor of obstetrics and gynecology, Washington University School of Medicine, St. Louis.

At right: As at the 1st Conference, tangible evidence of the interest and support of Hawaii's A.O.R.N. group was displayed. Here Martha Wingate, R.N., (l) and Mrs. C. P. White, both of Memorial Hospital, Sarasota, Fla., examine in detail the floral piece of native flowers specially flown to the Conference.

The O.R. Problem Clinic

by EDITH DEE HALL, R.N.

Are We Isolationists?

• The assertion that Operating Room nurses are isolationists is being made more and more frequently. According to Webster an isolationist is one who is aloof, one who wishes to be alone and avoid entanglements with others. This definition seems incomplete but in any sense is a misnomer for Operating Room nurses. The opposite seems true; we do not wish to be alone but are isolated by others in their thinking and planning. In order to bring about a change we need to know who makes the assertion and why.

For the most part the accusation comes from nursing leaders, educators, instructors and the general nursing staff in hospitals. Their lack of knowledge and understanding of our specialty, in all probability, supplies the reasons for the accusation. The technic of explaining away the factors and shedding light on the subject should help to overcome the criticism.

It has been said that Operating Room nurses seldom see the patient and are concerned only with the operative field. It is true that often we have not had personal contact with the patient prior to the time of operation but it seems incredible that anyone should think that we have no knowledge of or interest in the individual. Occasionally we find a nurse who is indifferent to everything except her pay check but that attitude is not confined to Operating Room nurses. It practically goes without saying that anyone who makes such extensive preparations, develops skills in technic, is generally alert to the responsibilities of this specialty, is just naturally interested in total patient care.

The opinions expressed by our lead-

ers lend importance to the situation. The fact must be faced that with very few exceptions, not one of them has spent as much as one half day in an operating room in recent years. All too often the picture that flashes through their minds is the routine passing of instruments or the preparation of supplies. Little thought is given or perhaps it has been forgotten that Operating Room nurses are exposed to a vast amount of information and a valuable learning experience. They are interested in the pre-operative care of the patient, the chart, x-rays, laboratory reports, history, diagnosis, pathology and prognosis. They are alert to the steady flow of informative conversation between the surgeon, his assistants and the anesthesiologist. Operating Room nurses recognize changes, abnormal conditions and emergencies during surgery. As members of the team they have a vital interest in the result of a combined effort. It has been my experience that surgeons include the Operating Room nurse in their teaching and often point out any unusual pathology. This need not be done at the time of operation but it is not uncommon for them to answer questions, open a specimen or even draw a diagram to give information to the nurse. Naturally every hospital is entitled to its share of prima donnas among the surgeons but if such is the case she may find out what she wants to know from other members of the team.

The Operating Room nurse is also interested in the post-operative care and recovery of the patient. She may visit the patient, make inquiries of the surgeon, resident or nurse, in order to follow up the case. How often does a nurse who is caring for patients observe a new type of operation so that she may have a better understanding? We are too apt to think of this as an experience for the student nurse but would it not be well if our leaders, directors of nurses and head nurses occasionally observed an operation from beginning to end? We do not expect them to keep up with all new developments and technics but it would be helpful to have a better understanding and realization that we, too, are coping with realistic situations not found in books. Our department is housing a valuable learning experience and one that cannot be duplicated elsewhere in the hospital.

Complex responsibilities and functions that differ greatly make the Operating Room dependent upon many departments in the hospital. If we were isolationists we would cease to function efficiently and a smooth running service would be impossible. Every Operating Room nurse, if she is wise, develops the best possible interdepartmental relationships. She depends upon others for prompt reliable service and must always keep in mind that a patient under anesthesia cannot wait. Good service is assured by good relationships. The Operating Room supervisor's daily contacts, cooperation and consideration for others go a long way to bridge any gap and promote better patient care.

In conclusion, Operating Room nurses should take a firm stand against being called isolationists. We should assume a full share of responsibility in the welfare of the hospital, in problem solving, in every measure that has to do with better and safer service to the patient. An invitation for others to spend some time with us is in order. We are not being presumptuous when we feel that it would be helpful. We all need to apply the ever popular three C's—Cogitate, Coordinate and Cooperate.

Above: Officers of Middle Atlantic anesthetists' organization, shown at the seventh annual meeting of the Middle Atlantic Assembly of Nurse Anesthetists in Atlantic City, are (l. to r.): Agnes M. Nagel, president, New Jersey State Association of Nurse Anesthetists; Dorothy C. Ball, outgoing chairman, Middle Atlantic Assembly; Doris Nugent, president, New York Association; Goldie Brangman, new chairman, Middle Atlantic Assembly, and Lourene George, president, Pennsylvania Association.

What Can We Teach the Student Nurse in the Operating Room?

By Frances F. Ross, R.N.
Former OR Supervisor, John Gaston Hospital and Instructor in OR Nursing,
University of Tennessee School of Nursing, Memphis, Tennessee

(The following paper was presented at an operating room institute held in Memphis.)

• The nursing profession is a progressive one. In the present era of curriculum changes in schools of nursing, the trend of nursing educaton is to shorten or eliminate the student nurse's experience in the operating room. The professional nurses in operating room nursing cannot appreciate this attitude toward the surgical experience. Therefore, it is up to the instructors and educators in OR nursing to bring to light the exact learning outcomes in this particular field.

What are some of the nursing values the student nurse can be taught in the operating room before graduation? If one compares the experience of the student in the surgical theater today to that of 20 years ago, the value of learning situations can be seen. Then, the student often assumed such responsibilities as those of the graduate nurse of today. Along with these advanced

responsibilities, she was also assigned to menial tasks now performed by auxillary personnel.

The changes which have occurred in work assignments give the instructor and supervisor of today more time for guiding the student and teaching her operating room nursing instead of technic only. Now, each student is taught as an individual. We will encourage the one who shows a native capacity for OR nursing, but we also guide the slow student who does not reveal a particular aptitude in this field. Twenty years ago, the slow student many times was ignored, and about all she learned in the operating room was how to wash gloves or fold linen. Little consideration was shown for the importance of surgery in relation to the student's entire nursing experience. Today, the primary purpose of operating room nursing is to promote the good health of the individual patient. Every nursing procedure and all acquired knowledge and skills are for the welfare of the patient.

Two of the most important things learned in the operating room are aseptic technic and teamwork. In the OR, the student becomes increasingly skillful in the application of aseptic technic which is the basis of OR technic. She learns to function effectively in nursing situations in which asepsis is essential. Early in her nursing career, she is taught the fundamental principles of asepsis in the courses of bacteriology and principles of nursing, but where else in the hospital except the operating room can she apply these learned fundamentals exactly? Here she learns that an article is either sterile or unsterile. She can see why asepsis is essential, and sometimes she may see the ill effects of failure to carry through strict operative asepsis. The student learns the continuity of asepsis in the cleansing of articles, their sterilization and use in the surgical unit.

In all phases of nursing, the importance of teamwork can never be overemphasized. In the operating room the qualities of teamwork are more essential than in any other area of the hospital. All members of the operating team depend on one another to carry through the exact duties of their roles as members of the team. The surgeon is the leader of the team, but he depends upon his assistants, the operating room nurses, the anesthetist, the ward nurse, and even the personnel who clean and sterlize the equipment, to perform their duties with a sense of obligation and responsibility.

The student learns many "whys" and "wherefores" during her OR experience. She has studied bacteriology, but in the operating room she applies her knowledge in the routines of "scrub-ups" and cleansing of the operative site. Now she can see why it is important for her to know the structure and bacterial flora of the skin.

Textbook pictures and explanations of anatomy have been shown to the student nurse, but in the operating room, she actually sees the structures and organs in relation to each other; she can see the difference in normal and abnormal tissues. She can be taught surgical pathology in the living human body. She can see the diagnostic and operative aid of the x-ray to the surgeon. She has been told of surgical positions, but she never sees many of these positions in use until her experience in the OR.

The student acquires some dexterity in performing the more common nursing procedures and skills in the OR. She has the opportunity to observe advances in operative technics as cardio-vascular, thoracic, plastic, and neuro-surgery. She learns surgical terminology and definitions common in the OR and surgical nursing. She learns to use these terms intelligently in conversation and presentation of information.

Various lists of the qualities of a "good nurse" are presented to the student nurse. In the OR, she can integrate this list with every learning situation she encounters. The instructor makes every assignment and lecture a learning situation, so that the student can learn the importance of honesty, integrity, conscientiousness, alertness, patience, and initiative.

A patient-care study, conducted orally, has been used as a learning situation at the University of Tennessee School of Nursing for one year. Students say it helps them develop a meaningful attitude toward OR nursing. It is important to impress the student with the fact that it is an enjoyable learning situation, not a long, drawn-out task. Undesirable hours are the disadvantages. The student works the 3-11 shift one day and is back to duty for the 7-3:30 shift the next day. However, the students enjoy the patient-care studies so much that they do not mind these undesirable hours for the few times they are assigned to them.

The day the student is on duty from 3-11 she and the instructor review the outline (shown on next page) together and select a patient who will have surgery at 8 o'clock the following morning and presents a valuable learning situation for the student. The student gives preoperative care to the patient that evening. In the morning she gives him the preoperative medication, brings him to surgery, stays with him during surgery and goes back to the ward with him to give postoperative care. If there were a recovery room, she would stay with the patient there until he recovered from the anesthesia. In our hospital she stays with the patient on the ward until he recovers. The student's classes in other subjects presents a problem, but this always seems to be one of the problems in teaching effective OR nursing.

The next day the student and instructor have an informal conference to discuss thoroughly the care of the patient. The student has taken notes to remember details. This conference is an excellent opportunity for the instructor to guide and teach the student in the complete care of the patient.

The student also visits the patient periodically until he is discharged from the hospital. This gives her the opportunity to see the end result of the surgery and give further health guidance to the patient.

The student has two or three patient-care studies during her OR experience. Through these, she is able to coordinate preoperative, operative and postoperative nursing care of the surgical patient. She will be more capable of giving good preoperative and postoperative care in the future because she knows what happens to the patient in surgery.

Patient Care Study in the Operating Room

Name of patient
Ward
Age
Sex

I. Preoperative care
   a. Diagnosis
   b. Duration of illness
   c. Prognosis
   d. Treatments given by student. Reasons for treatments.
   e. Medications given by student. Reasons for medication.
   f. Mental attitude of patient
   g. Health guidance
      a. Mental
      b. Physical
      c. Family contact
      d. Community agencies

II. Operative care
   a. Preoperative medication. Reason for medication.
   b. Name of operation
   c. Scrub or circulating nurse
   d. Anesthetic
   e. Mental attitude of patient prior to surgery
      (Note effect of preoperative medication)
   f. Condition of patient at end of surgery

III. Postoperative care
   a. Length of time spent with patient on ward
   b. Treatments and medications given. Reasons.
   c. Condition of patient when student returned to OR

IV. Have you benefited from this patient-care study? If so, how?

From similar learning experiences, the student will develop an appreciation of the field of surgery and its place in the preventative and curative aspects of disease. She can see the relation of surgery to the patient's complete restoration to health and return to society.

One of the most debated subjects is the length of time the student should spend in the operating room. Some hospital schools of nursing give the student three months in surgery. She can learn the essentials of good operating room nursing in a shorter length of time, and often we find the student replacing paid personnel in this situation. At this time of experimentation, the six to eight week period appears to be an effective length of time for the operating room. The student can be taught the basic principles and knowledge of operating room nursing and also have the advantages of applying this knowledge. It is ideal to have an instructor in OR nursing with no additional responsibilities. She then has ample time for guiding, teaching and supervising

the student at all times. If she also has the responsibilities of the operating room supervisor, her time spent with students is limited. Either way, graduate nurses and doctors are depended upon to help teach the student nurse.

IS FOUR-WEEK PERIOD ENOUGH?

Nursing educators in some collegiate schools of nursing propose a four-week period in surgery. Operating room nursing then may be integrated into the courses of medical-surgical nursing. This looks very "educational" on paper and does seem to be a very good approach to teaching effective OR nursing. But does the student have the time and capacity to learn applied skills plus the "why" and "wherefore" in this short period? Some nursing educators say the student can learn the skills after graduation. Senior students and graduates whom I have encountered appreciate having practiced skills to some extent in one operating theater, thus making it easier for them to understand thoroughly the basic principles. Also, with these basic principles and some applied practice, the new graduate OR nurse can reflect her knowledge and experience to any OR unit. She can adjust to different operating units in a shorter period of time.

In teaching situations in which it is possible for a full-time instructor to teach not more than six to eight students during six or eight weeks, can't she teach the principles and skills in an effective manner which would eliminate the need for a postgraduate course in OR nursing? If the student shows potential abilities and interest in OR nursing, perhaps she can return to the OR during her senior year for additional experience.

DANGERS IN ELIMINATING OR

Some nursing educators wish to completely eliminate OR nursing from the curriculum. They contend that the student may be a hindrance to the surgical team; that the OR is too much of a "specialty" than can be learned after graduation; or that the duties of an operating room nurse are so technical that they can be taught to anyone. If the student nurse is a hindrance, the learning graduate who has never been exposed to the OR would also be a hindrance to the surgical team. How many graduates will choose the operating room as their field of nursing if they do not learn enough about it as a student to look forward to job satisfaction? The graduate probably would be willing to let the technicians take over the OR because she might think of OR nursing as merely mechanical and technical. Those in the field know that "anyone on the street" cannot be taught technical skills, hence the careful selection of applicants to be trained as surgical technical aides. If the student does not receive operating room experience, the shortage of graduate nurses in the OR will present a tremendous problem. The well-run OR must have graduate nurses to carry the responsibilities of organization, insight, and leadership in order to guide and supervise the auxillary personnel who are taught techncal skills.

Now is the time for operating room nurses, especially instructors and supervisors, to work closely with nursing educators, not to defy them, but to convince them that OR nursing is essential to complete the total nursing education of the student nurse.

Above: Members of the committee which planned the institute included (l. to r.): Frances F. Ross, R.N., O.R.S., Institute chairman and author of the article beginning on page 93; Grace Powell, R.N., Assistant O.R.S., Methodist Hospital, Memphis; Catherine Abel, R.N., O.R.S., Campbell Clinic, Memphis; Margaret Jenkins, R.S., Assistant O.R.S., John Gaston Hospital, Memphis, and Frances Martin, R.N., Assistant O.R.S., Memphis Eye, Ear, Nose and Throat Hospital. Others on the committee, not pictured, were June Parish, R.N., St. Joseph Hospital, Memphis and Jeanetta Loyall, R.N., Veterans Administration Medical Teaching Group Hospital, Memphis.

Question Box

Each month questions pertaining to O. R. problems and technics will be answered by Dr. Carl W. Walter, nationally known for his operating room technic courses and as the author of "Aseptic Treatment of Wounds" (MacMillan). Questions should be addressed care of the O. R. Editor, Hospital Topics.

Q. We should like to know your opinion of the following:

(1) What is the latest trend in the use of masks?

(a) In the operating room

(b) In an isolation hospital

(2) How frequently should masks be changed?

(a) During the course of an operation

(b) In an isolation hospital or unit

(3) What is the theory on the use of scrub brushes with the use of pHisoHex*?*

(a) In the operating room

(b) In an isolation hospital

(4) Would it be possible to obtain standard scrub technic for

(a) An operating room with the use of pHisoHex

(b) A scrub technic for an isolation hospital

A. I know of no change in the philosophy of wearing masks in surgery for any case. They should be laundered before use to mat the fibers and should be changed every 30 to 45 minutes inasmuch as they lose their filtering action once moist with perspiration and saturated with expelled air. They should be worn to cover both the nose and mouth. In an isolation unit, they are worn when the

disease is one transmitted through the respiratory tract, and are changed every time a unit is entered.

Inasmuch as mechanical friction plays a major role in the removal of bacteria from the skin, nylon bristled brushes should be used regardless of the disinfecting agent being used. In the operating room, the initial morning scrub should be performed with a brush and any of the detergents or soaps incorporating G-11.

Following this, if the skin of the hands and arms is not grossly contaminated, a simple wash between cases is adequate. In the isolation unit or nursery, the individual should go through a complete scrubbing cycle on arrival, using a brush and a G-11 germicide. Following this initial scrub, the hands are simply washed thoroughly with the agent after each patient contact.

An adequate surgical scrub varies with the condition of the skin. Skin soiled with the usual grime picked up through daily contact can be disinfected by a mechanical scrub contacting all areas of the hand. Friction alone removes the soil, desquamating epithelium and bacteria to a point where further scrubbing is of no avail.

Once this stage has been reached, the bacterial flora on the skin will re-establish itself gradually over a ten day period. Accordingly, those who scrub daily have a minimal bacteriologic problem which can be met by a brief mechanical scrub to remove soil and keep the desquamating epithelium scrubbed off the hands.

Following trauma to the skin such as changing a tire, or working in a garden, etc., where gross soil is implanted in the skin, thorough mechanical scrubbing is necessary to "recondition" the skin.

During bouts of upper respiratory disease or following the careless handling of septic dressings, the contamination of the skin with facultative organisms is so heavy that disinfection is difficult to attain.

The use of a bacterial suppressant, such as a hexachlorophene agent, will suppress the bacterial flora of a healthy skin to the vanishing point so that a brief daily scrub is all that is necessary to maintain optimum conditions. Synthetic detergents have been developed for use instead of soap because the danger of contact dermatitis, which occurs in about eight percent of hospital personnel, is avoided.

The ideal skin cleaner, therefore, is a synthetic detergent and hexachlorophene. The following technic is recommended for preoperative disinfection of the skin of the hands:

(1) Use a nylon bristle brush.

(2) Scrape the subungual space with the sharp edge of a stainless steel nail file.

(3) Keep the nails trimmed to 1 mm.

(4) Wet the hands and arms and brush thoroughly. Brush one shot of detergent on the skin of each hand. Add detergent as needed with sufficient water to make suds. Use the detergent sparingly. Rinse frequently.

(5) Develop an anatomic scrub so that every area of the skin receives the number of brush strokes (lengthwise of brush) as listed below:

(a) Those who scrub at intervals of more than three days:

30 brush strokes to the skin
50 brush strokes to the nails

(b) Those who scrub daily:

15 brush strokes to the skin
25 brush strokes to the nails

(c) Those who use G-11 routinely for washing their hands:

9 brush strokes to the skin
15 brush strokes to the nails

(6) Rinse under running water.

You will see that the surgical scrub is classified in accord with an evaluation of the skin's condition. It is equally effective using soap containing hexachlorophene.

Following the scrub described above, the arms are immersed for two minutes in an aqueous solution of a quaternary ammonium compound such as 1:1000 Zephiran. This acts as a single shot germicide to destroy bacteria on areas of the skin which have escaped the mechanical scrub. The quaternary is left as a film on the skin to exert its bacterial power under rubber gloves.

Between cases, it is satisfactory to remove gloves and repeat the arm soak without scrubbing.

In an isolation technic, when tuberculosis is encountered, the hands should be immersed in an orthophenylphenol compound or one of the alcohols, such as 70 percent isopropyl after each patient contact.

Q. I am told that sprinkling gloves with distilled water before they are autoclaved reconditions the rubber. We are using a glove washer and reconditioner. In the washing, drying, and powdering process, one of the main purposes of the machine is to recondition the rubber gloves. Is sprinkling gloves necessary when the washer and glove conditioner is used?

A. Packages of rubber gloves are hydrated with a spray of distilled water immediately prior to sterilization, to prevent superheating and charring of the textile wrapper and rubber. This is doubly important if a glove conditioner is used, because the conditioner extracts all moisture from the gloves, superheating is inevitable, and deterioration and destruction are rapid.

Q. We have had several wound infections postoperatively. We culture the operating rooms and sterile supplies at three month intervals and all of the cultures have been negative. The subject of wound infections was brought up at the surgical committee meeting and the doctors came to the conclusion that the infections were due to improper skin preparation. We prepare the operative area in the following manner:

The evening before surgery the skin is washed with septisol and shaved, it is rinsed with water, alcohol, and ether. We do not put a sterile dressing over the area. In the operating room the surgeons do their own skin preparation. Most of them scrub, gown, and glove and then wash the area with septisol, water, and apply tincture of Zephiran. I feel that there is a great danger of contamination from doing the prep in this manner, as the solution can easily splash back on the surgeon's gloves. (The surgeons do not change gloves after they have prepared the skin area.)

Our orthopedic surgeons have us do a sterile preparation which includes the application of alcohol packs which remain on the area for 18 to 24 hours preoperatively. In surgery they wear two pairs of gloves while preparing the area with ether, alcohol, and iodine. After they have prepared the skin area they remove one pair of gloves. We have never had an infection postoperatively on any orthopedic case.

I was asked by the chief surgeon to give a report of the different types of skin preparation at one of the meetings. I took most of my material from your book, Aseptic Treatment of Wounds. *The doctors would still like more information on the subject of skin preparation and also some information on the chemical reaction of alcohol and aqueous Zephiran.*

A. The following technic is proposed as the ideal for preparing a patient's skin for surgery:

In cases of elective surgery, the patient should be instructed to scrub the proposed operative site for five days prior to surgery with any of the soaps or detergents containing G-11. At operation, a lather is worked up on the skin with one of these agents and the area is shaved with a sterile, sharp, straight razor to remove the hair and desquamating epithelium. It is important to have a razor that has been heat sterilized as another step in preventing the spread of hepatitis.

After the skin is shaved, it may be scrubbed with alternate sponges wet with 1:1000 aqueous Zephiran and isopropyl alcohol, as described in Chapter 12 of *Aseptic Treatment of Wounds.* This will provide a contrasting detergent germicide effect.

In lieu of this technic, the skin may be prepared using an aqueous solution of iodine. A lather of coconut oil soap is worked up on the skin. The area is then flooded with one percent *aqueous* iodine and it is allowed to remain on the skin for one full minute. The excess is then removed with a sponge wet with isopropyl alcohol.

Ether has no part in skin disinfection. It is not a detergent, its germicidal activity is limited and its use contributes markedly to the explosion hazard in the operating room.

The "sterile 24-hour skin prep" contributes nothing to asepsis. It creates panic in the patient; the dressing keeps the skin wet with perspiration in which bacteria proliferate, and the patient arrives for surgery with macerated skin. The technic described above will present the patient with skin on which the bacteria have been suppressed almost to the vanishing point.

If gloves are used for preparing the skin, I feel they should be changed prior to surgery. Since few individuals are sufficiently skilled to avoid contamination, I feel that the surgical gown should be donned after the skin has been disinfected and the towels positioned.

Soaps and quaternary ammonium compounds are incompatible. In the presence of the former, the germicidal effect of the quaternary ammonium compounds is weakened and dermatitis results in a large percentage of people who contact one of these compounds with residual soap on their skin. Hence, care must be taken to thoroughly rinse off any traces of soap before applying one of these germicides.

Wound sepsis due to skin bacteria is seldom an epidemic problem except for patients who have been exposed to hosptial flora long enough to pick up virulent organisms that spread from established sepsis. Faulty sterilization, dirty floors, or carriers among the staff are more frequent sources of dangerous organisms.

Body Temperature Studies in Anesthetized Man

Effect of Environmental Temperature, Humidity, and Anesthesia System

By Robert E. Clark, M.D., Louis R. Orkin, M.D.
and E. A. Rovenstine, M.D., New York City*

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The possibility of great harm occurring as a sequel to marked elevations of body temperature is well known. Heat retention (also called heat stroke or heat pyrexia) may be associated with convulsions, coma, and psychic disturbances in the recovery phase.[1] In fatal cases, generalized degeneration of the neurons of the central nervous system, centrolobular liver necrosis, lower nephron nephrosis, and

*From the Department of Anesthesiology, New York University-Postgraduate Medical School and the Division of Anesthesia, Bellevue Hospital.

Dr. Clark is now at the State University of New York College of Medicine, Brooklyn.

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1. Ferris, E. B.; Blankenhorn, M.A.; Robinson, H. W., and Cullen, G. E.: Heat Stroke: Clinical and Chemical Observations on 44 Cases. *J. Clin. Invest.* 17:249, 1938.

widespread hemorrhages, especially in the lungs and subendocardial tissues, are found.[2] The similarity of the pathological lesions found in patients dying following fever therapy and those produced by anoxia from any cause has been stressed by Hartman[3]; hypoxia occurs at the tissue level because of increased metabolic oxygen demand associated with fever, which cannot be met by the cardiorespiratory transport system.

It has been suggested that liver cells in addition to the cells of the central nervous system are particularly susceptible to damage during high fever.[4] Jaundice is a well-recognized complication of fever therapy, and several deaths have occurred following such treatment in which extensive liver necrosis was found at autopsy. Lesser elevations of fever produce apparently reversible impairment of liver function.

In addition, hyperthermia imposes a severe stress on the cardiovascular system. Heating the entire skin area may lower the over-all peripheral resistance to two-thirds or half of normal, according to Bazett.[5] In order for an effective general circulation to be maintained, the cardiac output increases and splanchnic vasoconstriction occurs.[6] These cardiovascular responses to heat decrease the ability of the body to withstand further circulatory stress. Experimentally, exposure to a hot environment sufficient to cause a rise in body temperature decreases the ability of animals to survive hemorrhagic shock,[7] traumatic shock,[8] and shock secondary to thermal burns.[9] External thermal stress adversely affects the circulatory status of patients in congestive heart failure, as has been shown by Berenson and Burch; in normal subjects circulatory responses to positional change are impaired.

This clinic has been particularly aware of the serious nature of the problem of heat disorders during anesthesia for many years because of high temperatures and humidity in the operating rooms during several months of the year. Despite vigilance, in the past two years alone two children and one adult have had convulsions associated with hyperpyrexia while anesthetized. Certain similarities were notable in all of these cases. All occurred during the summer months, with the temperature of the operating room near 90 F and the relative humidity high.

2. Malamud, N.; Haymaker, W., and Custer, R. P.: Heat Stroke; a Clinico-Pathologic Study of 125 Fatal Cases. *Mil. Surgeon* 99:397, 1946.

3. Hartman, F. W.: Lesions of Brain Following Fever Therapy. *J.A.M.A.* 109:2116 (Dec. 25) 1937.

4. Bragdon, J. H.: The Hepatitis of Hyperthermia: Report of a Fatal Case. *New England J. Med.* 237:765, 1947.

5. Bazett, H. C.: Effect of Heat on the Blood Volume and Circulation. *J.A.M.A.* 111:1841 (Nov. 12) 1938.

6. Daily, W. M., and Harrison, T. R.: Study of the Mechaniam and Treatment of Experimental Heat Pyrexia. *Am. J. M. Sc.* 215:42, 1948.

7. Blalock, A., and Mason, M. F.: Comparison of Effects of Heat and Those of Cold in Prevention and Treatment of Shock. *Arch. Surg.* 42:1054 (June) 1941.

8. Ricca, R. A.; Fink, F.; Katzin, L. I., and Warren, S. L.: Effect of Environmental Temperature on Experimental Traumatic Shock in Dogs. *J. Clin. Invest.* 24:127, 1945.

9. Elman, R.; Cox, W.; Lischer, C., and Mueller, A. J.: Mortality in Severe Experimental Burns as Affected by Environmental Temperature. *Proc. Soc. Exper. Biol. & Med.* 51:350, 1942.

All three patients were acutely ill, having had peritonitis for 36 hours or longer before surgical intervention. The cause of the peritonitis was a perforated appendix in two cases, and was due to leakage from the duodenal stump following subtotal gastrectomy in the third. In every case, convulsions were preceded by a rapid, progressive rise in body temperature. Fortunately, prompt treatment directed toward controlling the convulsions, rapidly reducing the fever, and providing maximal oxygenation averted a fatal outcome in each instance.

The dangers of hyperthemia following anesthesia in children have recently been emphasized by Bigler and McQuiston.[10] Two deaths in infants attributable to this cause were reported. Knight[11] observed rises as high as 5 to 7 degrees F in body temperature following operations performed in the summer. These temperature rises appeared to be associated with elevated room temperature, prolonged surgery, heavy draping, and the use of the carbon dioxide absorption system. Burstein and Mark,[12] as well as Knight, have advocated cooling the inspired gases when to-and-fro or circle absorption systems are used in hot weather. The observations of rectal temperature during anesthesia made by Searles and Lenahan[13] show in a general way the effects of environmental conditions on body temperature.

TABLE 1.—*Age and Sex Distribution, Anesthetic Agents Used, and Duration of Anesthesia in Heat Study Cases*

	Type of Anesthesia System			
	To-and-Fro	Circle	Non-Rebreathing	Total
No. of Cases	67	54	43	164
Ratio of Males:Females	39:28	32:22	29:14	100:64
Age, Yr.				
12-20	4	..	7	11
21-40	10	13	9	32
41-60	26	20	9	55
61-70	21	14	11	46
Over 70	6	7	7	20
Anesthetic Agent				
Cyclopropane	58	41	..	..
Ether	9	13	..	..
Nitrous oxide-oxygen-thiopental	..	..	39	..
Nitrous oxide-oxygen-trichlorethylene	..	..	3	..
Nitrous oxide-oxygen-ether	..	..	1	..
Duration of Anesthesia				
Mean	3 hr. 57 min.	4 hr. 8 min.	4 hr. 34 min.	4 hr. 13 min.

No systematic study has been made to show the behavior of body temperature in the anesthetized subject under various conditions of room temperature and humidity. It would be desirable to know the critical temperature and humidity conditions above which heat retention becomes a frequent complication. Moreover, no clear relationship has been demonstrated between body temperature changes and

10. Bigler, J. A., and McQuiston, W. O.: Body Temperature During Anesthesia in Infants and Children. *J.A.M.A.* 146:551 (June 9) 1951.

11. Knight, R. T.: Elevation of Body Temperature During Anesthesia and Its Control. *Anesth. & Analg.* 21:117, 1942.

12. Burstein, C. L., and Mark, L. C.: Control of Temperature of the Inspired Atmosphere and Absorption Technique. *Anesthesiology* 9:197, 1948.

13. Searles, P. W., and Lenahan, R. M.: Changes in Skin and Rectal Temperature During Surgical Anesthesia. *New York J. Med.* 52:1896, 1952.

choice of anesthesia system. The present study was undertaken to provide more definite information about these matters that might be of value to the anesthesiologist and surgeon.

CLINICAL MATERIAL AND METHODS

Temperature measurements were made in 212 general hospital patients undergoing surgery and general anesthesia. The records of 164 of these patients were selected for a study relating body temperature changes with environmental temperature, humidity, and choice of anesthesia system. The criteria used in selecting these cases were as follows: Only cases in which surgical procedures lasted more than two hours were used. The subjects were patients weighing more than 90 lb. (40.9 kg.) who had no fever before operation and who showed no evidence of shock during the procedure.

The duration of anesthesia varied from two to nine and one-half hours; the average for all cases was slightly over four hours. The age of the subjects ranged from 13 to 85 years. Age and sex distribution are presented in table 1.

Small children were excluded because their smaller body mass and different physiological responses to heat render them unsuitable for comparison with adult subjects. Patients with fever were excluded from the study because it was assumed that they might differ from afebrile subjects in their responses to thermal stress. Rectal temperature was used as a measure of internal body temperature in 150 cases; gastric temperature was used in 9 cases; and low esophageal temperature was used in 5 cases. The mean body temperature for all subjects at the beginning of anesthesia was 99.2 F. The variation was from 97.0 to 100.8 F; however, less than 4% of cases fell outside of the range 98.0 to 100.2 F.

Patients in whom signs of hemorrhagic or traumatic shock developed during the course of the operation were not included in the study. Body temperature was regularly observed to fall after the onset of shock in these cases, and their inclusion was not considered permissible.

All patients except six received preanesthetic medication within 90 minutes of induction of anesthesia. Of these, all received a therapeutic dose of a belladonna drug, which in over 93% of cases consisted of 0.4 mg. of atropine. Meperidine was given to 52% of the patients in addition, and 35% received morphine.

Inhalation anesthesia, administered by endotracheal technique, was used in all cases. Three different anesthesia systems were used: to-and-fro absorption, circle absorption, and non-rebreathing technique. The first two mentioned were employed in a closed system in all cases in this series. The Stephen-Slater valve,[14] which permits no rebreathing of exhaled gases, was used in the third group.

The anesthetic agent employed with the to-and-fro and circle systems was either cyclopropane or diethyl ether. Cyclopropane was used approximately

14. Stephen, C. R., and Slater, H. M.: Nonresisting Non-rebreathing Valve. *Anesthesiology* 9:550, 1948.

four times more frequently than ether, with both the to-and-fro and the circle systems. More than 90% of the patients anesthetized with the non-rebreathing technique received nitrous oxide and oxygen supplemented with sodium thiopental. In the remaining cases either trichlorethylene or ether was the supplement (table 1). Flows of 6 to 12 liters per minute of nitrous oxide-oxygen were required; concentrations of nitrous oxide above 75% were not employed.

This study was conducted during the course of one calendar year. Thus it was possible to assess the responses of anesthetized patients to a graded series of thermal stresses related to seasonal changes. The operating suite in which the study was made is not air-conditioned. Instruments are sterilized by boiling in a room that opens directly upon two adjacent operating rooms. This arrangement results in considerable humidification of the room air. The overhead operating lights in use utilize four 250 watt incandescent lamps. The sterile draping system in practice in this hospital was used consistently throughout the study: four small doubled sheets ("clinics") were placed on the four sides of the field; one sheet, folded in half, was then placed respectively across the foot and one across the head of the table; finally, a laparotomy sheet was placed on top of these drapes.

The wet and dry bulb temperature of the room air was measured to within 0.5 degrees F with a sling psychrometer. Measurements were made at approximately 90 minute intervals during the procedure. The relative humidity was computed from psychometric tables.

Body temperature, and temperature within the anesthesia system and the airway, was measured with a Micromax 6 point recording thermocouple (manufactured by the Leeds and Northrup Co., Philadelphia). Copper and constantan wire thermocouples were used. The accuracy of this machine is ± 0.3 degrees F. A United States Bureau of Standards calibrated mercury thermometer was used to check the performance of the machine, and during many of the measurements, one thermocouple was kept in an ice bath as a reference point. The latter was desirable, although not essential, inasmuch as

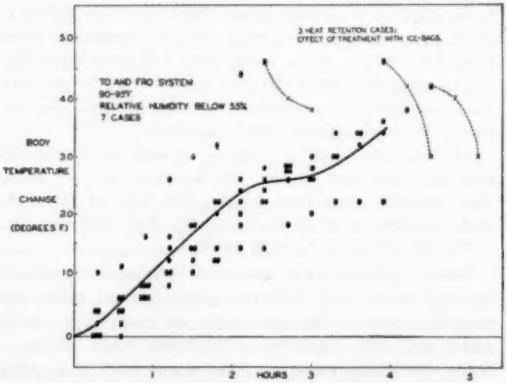


Fig. 1.—Body temperature changes during anesthesia in seven cases with the temperature of the operating room ranging from 90 to 95 F.

the machine utilizes a self-contained, known electromotive force instead of a cold junction as a basis for comparison with the electromotive force produced by the test thermocouple.

Temperature was recorded between points at one minute intervals; hence, the time between successive readings on any one thermocouple was six minutes. The rectal thermocouple, mounted in a plastic rod, was inserted 4 or more inches into the rectum at the earliest possible moment after anesthesia was established. Gastric or esophageal temperatures were

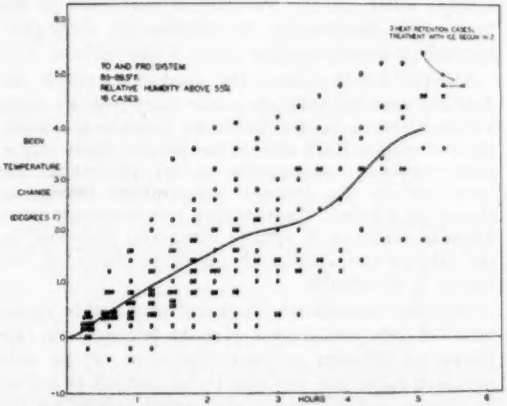


Fig. 2.—Body temperature changes during anesthesia in 16 cases with the temperature of the operating room ranging from 85 to 89.5 F.

obtained with a thermocouple mounted in a length of vinyl plastic tubing (2.5 mm. external diameter), which had been stiffened by treatment with heat. Fine, unsheathed, insulated thermocouple wires were used to obtain temperatures in the airway and in anesthesia equipment. Low tracheal or carinal temperature was obtained by inserting such a wire a measured distance beyond the tip of the endotracheal airway, usually 3 to 4 cm. Temperature in the to-and-fro cannister was measured in the proximal one-third of the cannister. Measurements were made at several locations in the circle cannister, through holes drilled in the sides; only measurements made in the proximal one-third are described herein. Temperatures were measured in the accordion tubes of the circle machine. Two thermocouples were placed in the inspiratory tube, one 4 in. from the Y piece and the other adjacent to the machine; two other thermocouples were similarly placed in the expiratory tube. The accordion tubes used were 31 in. (77.5 cm.) long. The temperature under the drapes adjoining the chest, the flank, the hip, and between the thighs was measured. Thermocouples were placed about 3 cm. from the body and were protected from moisture.

The mean temperature was computed from a series of observations in a number of patients, six minutes apart over a period of two or more hours. Two to-and-fro, or two circle cannisters were alternated at hourly intervals, and were not cooled. Data upon which mean cannister temperature was based were only those observed when the patient was

breathing through the test cannister, not during the cooling period of the cannister.

RESULTS

The effects of room temperature, humidity, and anesthesia system on body temperature were analyzed in the following way. Body temperature change, whether a rise or a fall from the initial recorded internal temperature, was plotted against the duration of anesthesia in hours. The body temperature records were then grouped in two general ways, according to environmental conditions: first, by the dry-bulb temperature of the operating room (in 5 degree F ranges), and each range divided in two subgroups according to whether the relative humidity was above or below an arbitrary figure of 55%; second, solely by the wet-bulb temperature of the room. The distribution of patients by these two methods is shown in tables 2 and 3 respectively.

TABLE 2.—*Distribution of Heat Study Cases According to Dry-Bulb Temperature Range (F), Relative Humidity, and Anesthesia System*

Relative Humidity	Type of Anesthesia System			
	To-and-Fro	Circle	Non-Rebreathing	
Below 55%				
75-79.5	6	12	4	
80-84.5	18	21	17	
85-89.5	12	7	8	
90-95	7	3	3	
Above 55%				
80-84.5	5	5	5	
85-89.5	16	6	3	
90-95	3	..	3	
Totals	67	54	43	Grand Total 164

TABLE 3.—*Distribution of Heat Study Cases According to Wet-Bulb Temperature Range and Anesthesia System*

Wet-Bulb Temperature, F	Type of Anesthesia System			
	To-and-Fro	Circle	Non-Rebreathing	
58-64.5	8	17	11	
65-69.5	15	19	11	
70-74.5	19	8	11	
75-82	25	10	10	
Totals	67	54	43	Grand Total 164

Figures 1 and 2 show the manner in which the data for each temperature range were plotted; some 30 other charts cannot be shown because of limitations of space. Each dot on the scatter chart represents the body temperature of one patient at the time shown; the average temperature change is shown by a curve. Temperature measurements were actually made at 6 minute intervals; however, in the interests of clarity, the interval shown on the charts is 18 minutes.

One fact immediately apparent is the wide variability of rate and degree of body temperature rise shown by different patients. The slope of the temperature curve for any particular patient is apt to be bumpy and irregular, apparently related to the variable degree and intermittent character of sweating seen in these subjects. A definite trend in the

course of the body temperature is usually discernible however.

In figure 1, at a dry-bulb temperature of 90 to 95 F with the relative humidity below 55%, three out of seven patients anesthetized with the to-and-fro system had heat retention requiring therapy with ice-bags. This occurred after 2.5 hours, 4 hours, and 4.5 hours of anesthesia. Significantly, the average wet-bulb temperature for the seven cases was 76.5 F. Only part of the cooling curve of the treated patients is shown; however, the effectiveness of therapy can be clearly seen.

At 80 to 84.5 F, with the relative humidity above 55%, two of five patients anesthetized with the to-and-fro system were on the verge of heat retention after 3.5 hours (not shown). The average wet-bulb temperature was 74 F. Heat retention was averted in one patient by the application of ice-bags, and in the other when severe hemorrhagic shock supervened.

Heat retention occurred in 3 out of 16 patients in whom to-and-fro absorption was used at 85 to 89.5 F, with the relative humidity above 55% (fig. 2). The average body temperature rise for the group as a whole was over 4 degrees F in five hours. The average wet-bulb temperature was 77.5 F.

At 90 to 95 F with the relative humidity above 55%, the body temperature rose at a rate of over 1 degree F per hour in three patients anesthetized with the to-and-fro system (not shown). The average wet-bulb temperature was 81 F. Heat retention

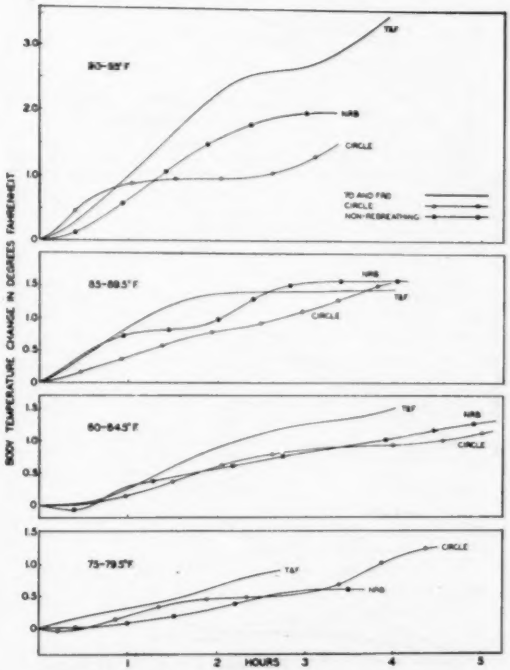


Fig. 3.—Average body temperature curves during anesthesia with the operating room temperature at various ranges but the relative humidity always below 55%.

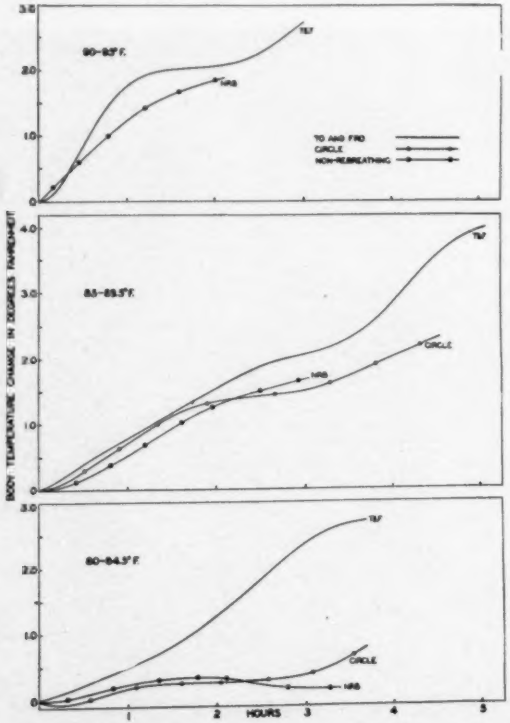


Fig. 4.—Average body temperature curves during anesthesia with the operating room temperature at various ranges but the relative humidity always above 55%.

developed in only one patient, but in both of the other two it was imminent at the time surgery was terminated. Under comparable conditions, heat retention developed in only one patient anesthetized with the circle or non-rebreathing system.

The average body temperature curves for the data grouped by dry-bulb temperature range, with the relative humidity below and above 55%, are summarized in figures 3 and 4.

Average body temperature curves plotted solely in relation to the wet-bulb temperature are shown in figure 5. From the statistical standpoint and for reasons that will be discussed, this figure is the one best suited for comparing the heating effects of the three anesthesia systems.

At wet-bulb temperatures below 75 F, the height and rate of body temperature rise were slightly but consistently greater in patients anesthetized with the to-and-fro system than when the circle and non-rebreathing systems were used. Above 75 F, this effect was considerably more marked. The rate and height of body temperature rise was similar with both the circle and non-rebreathing systems, although it was sometimes slightly higher with the latter.

The results of air temperature measurements under the drapes, adjoining the subject's body, are shown in table 4. The temperature between the interradiating surfaces of the thighs approached body temperature closely; only measurements made adjacent to the chest, flank, and hip are included in the

results shown in the table. The air temperature under the drapes was 8 to 10 degrees warmer than room air when the latter was 80 to 90 F. Above a room temperature of 90 F, the temperature under the drapes approached body temperatures. The results of temperature measurements made in the airway, and in various locations in the three anesthesia systems studied, are shown in tables 5 and 6. Attention is called to the variation in temperature observed. The manner in which average temperature was computed has been described. The average temperature relationships within the three systems are summarized in figure 6 (page 114).

COMMENT

Some of the undesirable effects that may result from heat retention have been mentioned. This type of heat disorder arises from a disturbance of the normal balance between heat gain to the body and heat loss.

The principal source of heat gain is internal heat production from the combustion of carbohydrate,

TABLE 4.—*Average Air Temperature Observed Under Surgical Drapes*

Room Temperature, F	Under Drapes, F	No. of Patients	No. of Measurements
75-79.5	89	22	586
80-84.5	93	30	1,194
85-89.5	96	11	419
90-95	98	13	309

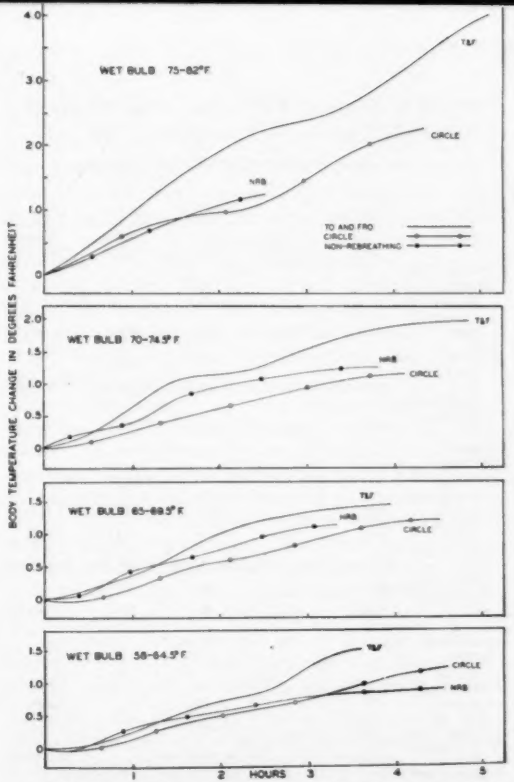


Fig. 5.—Body temperature changes with different anesthesia systems at various wet-bulb temperatures of the operating room.

TABLE 5.—*Average Fahrenheit Temperatures in Various Locations in To-and-Fro, Circle, and Non-Rebreathing Anesthetic Systems*

	Location				
	Bag	Canister	Adaptor	Mid-Tube	Low Trachea
To-and-Fro System					
No. of measurements	175	251	996	488	1,268
No. of cases	7	22	33	13	37
Variation, F	80.0-96.2	80.4-141.8	98.0-122.8	97.4-111.0	98.2-108.0
Mean temperature, F	86.6	116.2	105.8	103.1	101.8
Circle System					
No. of measurements	189	57	943	128	1,479
No. of cases	7	3	27	4	41
Variation, F	80.8-96.0	75.2-137.2	86.2-99.8	95.6-100.4	93.6-101.2
Mean temperature, F	86.9	117.5	91.7	97.9	96.9
Non-Rebreathing System					
No. of measurements	175	...	604	...	500
No. of cases	5	...	16	...	16
Variation, F	75.0-88.0	...	84.2-94.6	...	90.0-99.4
Mean temperature, F	81.1	...	89.7	...	94.1

protein, and fat, and to a minor degree from the specific dynamic action of protein. In addition, fever per se increases metabolic heat production by about 7% per degree Fahrenheit. Surgical patients may also gain heat from sources outside the body by radiation and conduction. Examples are the radiant heating effects of the operating lights and the warm bodies of the surgeons on the one hand, and heat gain from warm objects such as repeatedly applied hot laparotomy pads on the other.

For thermal equilibrium to exist, the summation of factors resulting in heat gain must be balanced by an equal loss of heat by the body. The significance of a rising body temperature during anesthesia is a disparity between these two factors. Heat loss is mediated solely by four physical processes: radiation, convection, conduction, and evaporation.

Heat loss by radiation is influenced chiefly by two factors: first, the difference in surface temperature of the subject and the objects surrounding him and, second, the effective radiating surface area. This

TABLE 6.—*Temperature Within the Accordion Tubing in the Circle System*

	Inspiratory Tubing		Expiratory Tubing	
	Adjoining Machine	Adjoining Y Piece	Adjoining Machine	Adjoining Y Piece
No. of measurements	159	159	39	39
No. of cases	6	6	2	2
Mean temperature, F	90.8	89.4	87.0	91.2

area is always less than the total body area because of interradiating effects. Radiation is the principal means of body heat loss at comfortable room temperatures. However, its importance decreases rapidly above 89 F, and radiation loss becomes zero when air temperature equals skin temperature.[15]

Conduction is not ordinarily an important means of heat loss. However, when large areas of the body are in contact with solid objects, conduction assumes greater importance. The use of a water-cooled mattress[10] or ice-bags are examples of the effective application of conductive heat loss. The former has the advantage of making use of a large portion of the body area that would not otherwise be available for cooling the body. Under operating room conditions, the methods that we have found most effective in treating pyrexia are those that utilize conduction.

Heat loss by convection is that heat lost by warming of the air that comes in contact with the body. Loss from natural convection is always small; however, forced convection is much more effective. Heat loss by the latter is proportional to the square root of the air velocity.[16] Surgical draping impedes convection. Moreover, the promotion of air currents in operating rooms by fans is not generally approved. As a consequence, forced convection as a means of heat dissipation is frequently unavailable to the surgical patient.

At comfortable room temperature (68 to 70 F), evaporation plays a minor role in body heat elimination; above 88 to 90 F, however, it is the principal means, and above 94 F it is the sole means by which body heat can be lost.[15] It can be seen from table 4 that above a room temperature of 85 F, the temperature under the surgical drapes is 96 F or more. Hence, above this room temperature, it is clear that in any patient in whom the sweating mechanism fails heat retention will almost certainly develop. It is our opinion that the lightest possible draping should be used during hot weather. Asepsis is actually maintained more satisfactorily with a light drape, for the patient is less likely to sweat through and contaminate it.

Water loss through the skin includes that which is transudated as well as that secreted by the sweat glands. On exposure to heat, the rate of transudation may rise to 50 ml. per square meter per hour or only about 10% of the output of the sweat glands under similar conditions. However, evaporation of transudates assumes importance when the sweating mechanism fails, e.g., heat retention, under conditions in which evaporation is the only means of heat elimination.

Suppression of sweating was uniformly observed before the onset of heat retention in all 10 cases in which it occurred during this study. This has been

15. Hardy, J. D.; Milhorat, A. T., and DuBois, E. F.: Basal Metabolism and Heat Loss of Young Women at Temperatures from 22° C. to 35° C. *J. Nutrition* 21:383, 1941.

16. Machle, W., and Hatch, T. F.: Heat; Man's Exchanges and Physiological Responses. *Physiol. Rev.* 27:200, 1947.

noted by others.[1] Heat retention was marked not only by the height to which body temperature rose but by its progressive and rapid rise. A rate of temperature rise of 1.2 to 2.0 degrees F per hour was observed at some time during the development of heat retention in all cases.

In some of the patients in whom pyrexia occurred, concomitant measurements of the posterior nasal temperature were made with a mercury clinical thermometer. This temperature was found to provide a very adequate means of detecting and following the course of heat retention. A rectal type thermometer is recommended to avoid the risk of breakage in the nose, and it is advised that the thermometer be inserted at least 2½ in. (6.25 cm.).

The key relationship upon which evaporative heat loss depends is the difference between the vapor pressure of water at skin temperature and the vapor pressure of water in room air. (The latter is equal to the vapor pressure of water at air temperature multiplied by the relative humidity.) When this difference becomes zero at wet-bulb temperatures above 96 F, heat loss by evaporation ceases. A fairly close parallelism exists between wet-bulb temperature and the vapor pressure of water at the wet-bulb temperature. For this reason, the wet-bulb temperature is the most important factor in determining the upper limits of tolerability of an environment, as has been shown by Eichna and associates.[17]

The dry-bulb temperature taken alone is a poor index of the thermal tolerability of an operating

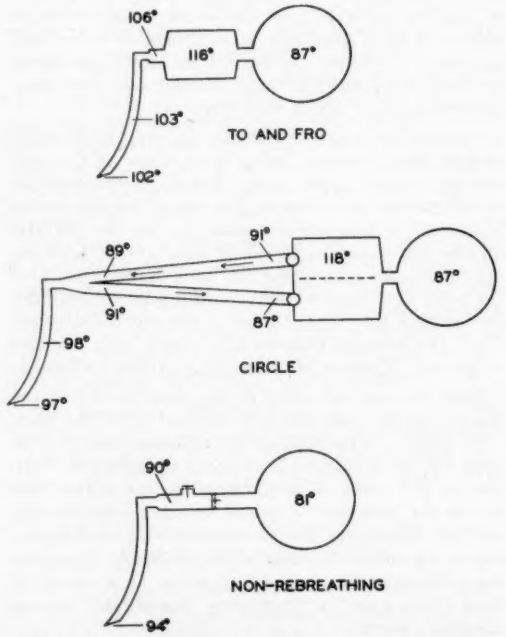


Fig. 6.—Average temperature (Fahrenheit) at various points in the to-and-fro, circle, and non-rebreathing anesthesia systems.

room. A comparison of figures 3 and 4 will make this clear. Both show body temperature changes occurring in relation to similar dry-bulb temperature ranges. However, in figure 4 where the relative humidity is high, the corresponding rate of temperature rise is distinctly steeper than in the other where relative humidity is low.

The relative humidity is misleading and unsatisfactory as a measure of the tolerability of an environment because it bears no absolute relationship to the vapor pressure of water in the air; the relative humidity may be the same at two different dry-bulb temperatures, and the moisture content be very different. Figure 3 illustrates the point; one is led to expect from the three lowest charts that, if the relative humidity is below 55%, evaporative loss will be adequate to prevent marked elevations of body temperature. However, the uppermost chart reveals rises in body temperature higher than some seen in figure 4. The explanation is that, although the relative humidity is below 55% in all the charts in figure 3, the average wet-bulb temperature is 76.5 F in the top chart and only 63 to 70 F in the bottom three.

Figure 5 shows the data replotted in relation to the wet-bulb temperature only. Without respect to system, the trends of body temperature rise follow intimately corresponding rises in wet-bulb temperature. It is to be noted that, above 75 F wet-bulb temperature, body temperature rises rapidly; this effect is marked in patients anesthetized by means of the to-and-fro system, but it also occurs when circle and non-rebreathing systems are used. In 10 patients in whom heat retention occurred, the average wet-bulb temperature ranged from 74 to 82 F; in only one case was the wet-bulb temperature below 75 F.

Evaporation of water from the lung normally dissipates about 10% of the body's heat loss. Warming the respired air to body temperature accounts for an additional 1 or 2%. The fact that this avenue of heat loss is both small and self-limited should be appreciated before any discussion of the effects of anesthesia system on heat economy is undertaken. For example, the non-rebreathing system permits free lung evaporation, yet this factor alone was not enough to prevent a slow rise in body temperature at comfortable room temperatures (fig. 5). This signifies that the summation of factors impeding heat dissipation or resulting in heat gain exceeded the effect of the patient's heat dissipating mechanisms including lung evaporation.

All gases have a very low specific heat; for this reason, only small amounts of heat are involved in heating or cooling large volumes of gas. For example, the heat loss to the body in raising the temperature of 500 liters of gas per hour in the non-rebreathing system from 81 F (fig. 6) to body temperature is 1.5 Cal. per hour. (Calculations: 500 liters times 10 degrees C times 0.0003 Cal. per liter per degree centigrade [specific heat of air] equals 1.5 Cal. per hour.)

17. Eichna, L. W.; Ashe, W. F., Jr.; Bean, W. B., and Shelly, W. B.: The Upper Limits of Environmental Heat and Humidity Tolerated by Acclimatized Men Working in Hot Environments. *J. Indust. Hyg. & Toxicol.* 27:59, 1945.

Much more important as a factor in heat exchange via the lung is evaporation. In the non-rebreathing system, anhydrous gases are inspired, and gases saturated with water vapor at about 90 F are exhaled through the valve. Seventeen grams of water per hour representing 9.8 Cal. per hour heat loss may be vaporized in such a system. (Calculation: 0.034 gm. of water per liter of saturated gas times 500 liters per hour equals 17 gm. of water per hour; 17 gm. times 0.58 Cal. per gram [heat of vaporization] equals 9.8 Cal. per hour.) The total heat loss, 11.3 Cal. per hour in this hypothetical example, represents about 16% of the 71 Cal. per hour basal heat production of an average-sized young man. It should be noted that, of this, over five-sixths is contributed by evaporative loss.

Lesser amounts of water are evaporated from the lung when the circle system is used. This can occur because gases saturated with water vapor are exhaled into the circle system at about 8 degrees F higher temperature than they return saturated to the patient. Gases return saturated because of the water produced by the neutralization reaction between carbon dioxide and soda lime. Condensation occurs in the accordion tube returning gases to the machine, which is at a lower temperature than the exhaled gas. Evaporation by this means is limited and is about 3.3 gm. of water per hour, corresponding to a heat loss of 1.9 Cal. per hour. (Calculation: the number of grams of water in 500 liters of saturated air at 97 F, the temperature of exhaled gases [0.0402 gm. per liter times 500 equals 20.1 gm.], minus the grams of water in 500 liters of saturated air at 89 F, the temperature of delivered gases [0.0335 times 500 equals 16.8 gm.] equals 3.3 gm. of water evaporated per hour. Besides this, 0.7 Cal. per hour is lost by warming gases to body temperature.) The total heat loss by the use of the circle system is about 4% of the basal heat production.

When the to-and-fro system is used, evaporation from the lung cannot occur because the temperature throughout the system is hotter than the exhaled gases (fig. 6). In fact, heat gain to the body results, not principally because of warming by hot gases, but because water condenses within the lung and airway when hot gases saturated with water vapor are cooled to body temperature. If the average temperature of inspired gases is 106 F, and it is assumed that the gas is cooled to body temperature by the time it reaches the alveoli, heat gain to the body through cooling of gases would be 0.6 Cal. per hour. On the other hand, the amount of condensation calculated to occur between lips and lung is 4.3 gm. of water per hour, equivalent to a heat gain of 2.5 Cal. per hour. (0.0532 gm. per liter times 500 liters minus 0.0442 gm. per liter times 500 liters equals 4.3 gm. of water per hour.) The total heat gain represents an increase of about 4% of the basal heat production.

Cole has recently proposed that condensation of water in the respiratory tract constitutes a hazard in the use of carbon dioxide absorption systems. Such condensation does not occur when the circle absorption system is used, as is shown above, but

only during the use of the to-and-fro system. The authors do not believe that this condensation per se constitutes any hazard to the patient, but may be disadvantageous only from the standpoint of the resultant heat gain to the body. At comfortable environmental temperatures, patients may be anesthetized for many hours by the absorption technique with no harmful effects whatsoever. Under these conditions, alternative avenues of heat dissipation besides evaporation from the lung are available.

On the other hand, under conditions of severe external thermal stress, i.e., wet-bulb temperatures of 75 F or higher, the heat dissipating mechanisms of the body are taxed greatly. Here, the use of the to-and-fro system, which results in a 4% heat gain rather than varying amounts of heat loss afforded by the other systems, is frequently associated with heat retention. In 9 of the 10 cases in this study in which heat retention developed, the to-and-fro system was used.

The quantitative differences in rate of body temperature rise with the three anesthesia systems are best seen in figure 5. This figure is chosen because here body temperature change is shown in relation to wet-bulb temperature, the most valid measure of the thermal stress of an environment. In figures 3 and 4, the issue of system effect is clouded by the vagaries resulting from subdivision according to dry-bulb temperature.

The height and rate of body temperature rise in patients anesthetized with the to-and-fro system were slightly but consistently greater than that seen in cases in which circle or non-rebreathing systems were used. This effect was considerably more marked above 75 F wet-bulb because of the greater number of patients in whom heat retention developed with the to-and-fro system. The reason for these effects seems to be clearly related to the differences in heat exchange via the lung that have already been discussed. Applying ice-bags to the to-and-fro cannister has been shown elsewhere[12] to reduce the air temperature effectually within the system. By this means, it may be possible to reduce the incidence of heat retention with use of the to-and-fro system to a level comparable to that of other inhalation systems.

Not as readily explained is the similarity of body temperature rises seen with the use of the circle and the non-rebreathing system. The non-rebreathing system should permit dissipation of 16% of the basal heat production, as compared with only 4% by the circle system. However, the temperature rise in certain of the charts in figure 5 is slightly higher with the non-rebreathing than with the circle system. No completely satisfactory explanation for this can be offered. It may be significant, however, that all patients anesthetized with the non-rebreathing system breathed spontaneously throughout, and respiration was not assisted. The respiration of most of the patients anesthetized with circle absorption was assisted, and in some, controlled respiration was performed. It is possible that the average respiratory minute-volume in the circle cases may have been greater than that in the non-rebreathing group.

Since heat loss from the lung is directly related to the minute-volume, this may provide a partial explanation. In addition, since muscular activity increases heat production, controlled or assisted respiration should be associated with less internal heat production than when respiration is spontaneous.

Mention should be made of the treatment of heat retention in patients undergoing surgery. At the outset, the object of treatment should be clearly defined, i.e., the rapid reduction of the elevated body temperature. This is the paramount consideration, because to permit body temperature to remain markedly elevated is to risk injury to the central nervous system and liver and circulatory collapse. In experimental hyperthermia, the survival rate of animals is directly related to the speed with which the body temperature is lowered to normal limits.[9]

It should be added that it is no simple matter to prevent progression of hyperthermia in an adult of large body mass, and even more difficult to lower his body temperature to normal. The surgical draping not only impedes convection and evaporation but severely limits the body surface area available for cooling therapy. Under these circumstances, evaporative cooling methods, including the vaporization of volatile liquids on the skin, have proved effectual in our hands. As was mentioned previously, under operating room conditions, the most effective methods of treating pyrexia were found to be those that utilized conduction—the water-cooled mattress and ice-bags. In treating a large group of nonsurgical patients with heat retention, Ferris and co-workers[1] also concluded that evaporative methods reduced body temperature too slowly and recommended therapy with ice.

The effectiveness of ice-bags, properly placed and used in sufficient numbers, in promptly relieving dangerous degrees of hyperthermia is clearly shown in figure 1. The preferred locations for placement of ice-bags, insofar as the surgery permits, are between the thighs, the inguinal regions, axillas, flanks, and chest. In adults, eight or more bags, frequently refilled, are often required to reverse the course of a rapidly rising body temperature. Ice-bags, though somewhat inconvenient to use effectively, have the advantage of being generally available in hospitals.

The convenience of the water-cooled mattress when available, and its effectiveness used prophylactically in children is indisputable.[10] Our experience with the mattress has been limited to its use in children, where it has proved very satisfactory. Extension of its use to adults can be recommended. Other effectual contributory methods of treating heat retention include lightening the surgical drape and promoting air currents under the drapes.

Of lesser value in treatment are the use of evaporative methods of cooling, lightening of anesthesia (to lessen depression of the central thermoregulatory center), adequate replacement of water and salt, and changing from the to-and-fro anesthesia system to one that permits dissipation of heat by the lung. These less effectual methods are supplementary and should never be relied on alone to lower marked elevations of temperature.

Heat retention in surgical patients can be prevented. Air conditioning is of course very desirable from this point of view. Where air conditioning is not available, it is advisable to postpone elective surgical procedures when the wet-bulb temperature of the operating room is 75 F. or above.

The results of this study indicate that above this temperature, body temperature tends to rise substantially during prolonged operations regardless of the anesthesia system. Light surgical draping of the patient is strongly recommended during warm weather. Use of the to-and-fro anesthesia system is best avoided, or if it is used, the cannister should be cooled with ice. Low doses of belladonna premedicant drugs are advisable since they decrease sweating.[18]

Patients should be brought to the operating room adequately hydrated and with any salt depletion corrected; fluid losses during surgery should be carefully replaced. Frequent measurements of the patient's body temperature should be made (the posterior nasal temperature is convenient to measure and is satisfactory) in order to permit prompt recognition of heat retention in its incipiency and institution of appropriate therapy. In addition, cessation of sweating should be regarded as an urgent danger signal. The value of the water-cooled mattress in prophylaxis has already been mentioned. All of the preceding remarks apply with special force in children, in whom the factors of a small body mass, high internal heat production, and immature thermo-regulatory responses make heat retention a particular hazard.

SUMMARY AND CONCLUSIONS

Temperature measurements were made in 212 patients undergoing surgery and general anesthesia. The body temperature of 164 adult patients undergoing lengthy operations was studied in relationship to environmental temperature and humidity and choice of anesthesia system. The temperature rebreathing anesthetic systems were made. The dry-bulb temperature under the surgical drapes was measured over a 20 F room temperature range.

The wet-bulb temperature is the most satisfactory measure of the thermal tolerability of an environment. Below 75 F wet-bulb temperature, heat retention is uncommon in adult subjects who are afebrile before operation. Above this temperature, body temperature rises progressively, and sometimes markedly, regardless of the anesthesia system used.

Below 75 F wet-bulb temperature, the height and rate of body temperature rise is slightly but consistently greater in patients anesthetized with the to-and-fro system than when the circle or non-rebreathing systems are used. Above this temperature heat retention is much more frequent when the to-and-fro system is used than when circle or non-rebreathing techniques are employed. The reasons for these effects are discussed.

Heat retention is usually associated with cessation of sweating under conditions where evaporation is the principal means of heat dissipation. The rate of body temperature rise during heat retention may be as high as 1.2 degrees F to 2 degrees F per hour in adults. Methods of prevention and treatment of heat retention during surgery and anesthesia are discussed.

The O.R.

What is the Educational

By Sister St. Bernadette, S.M., R.N.
Director of Nurses
Misericordia Hospital School of Nursing
New York City

BECAUSE of the acute shortage of nursing personnel during and after World War II, care of the postoperative patient has been a difficult problem in many hospitals. Caring for these patients in central recovery rooms was found to be one of the most efficient and safe means of furnishing the necessary care of the postoperative patient.[1]

The purpose of our study was to determine the educational value of the recovery room in the assignment of student nurses. While the advantages of the recovery room from a nursing service standpoint are known, there is no evidence that its educational value in the instruction of student nurses has been studied.

For the study, we defined the recovery room as follows: A recovery room is a special observation room to which postoperative patients recovering from anesthesia are taken for immediate postanesthetic and postoperative care under skillful supervision.

From experiences acquired in both the administration of anesthesia and several years of contact with student nurses on the surgical ward, we observed that student nurses encounter many problems in caring for the postoperative patient. Because of these observations, we assume that there is a need for a more intensive and carefully planned experience for the student nurse in this particular aspect of nursing care. This assumption is based on several tragic incidents in our experience with student nurses, two of which will be considered here.

In one instance, the student nurse showed a definite lack of knowledge in caring for the anesthetized patient. Alarmed at the partial respiratory obstruction of a postoperative patient, she left the room to summon help. In the meantime, cyanosis had developed to an alarming de-

[1]Shupp, Miriam G., "Panel Discussion," **The Bulletin of the American Association of Nurse Anesthetists**, Vol. X, No. 4, November, 1942, pp. 261-72.

Recovery Room . . . *A Symposium*

Value of Recovery Room Assignment?

(Abstract of a dissertation, "A Study of the Existing Educational Value in the Assignment of the Student Nurse to the Recovery Room," submitted to the faculty of the School of Nursing Education, the Catholic University of America, in partial fulfillment of the requirements for the degree of Master of Science in Nursing Education.)

gree. The simple procedure of supporting the jaw is all that would have been required to achieve a clear airway and spare the student from an emotional shock.

On another occasion, a student nurse had been taught to lower the shade before the patient returned to his room. Attributing the change of the patient's color to the dimness of the room, she sat there confident that everything was all right. Contrary to his practice, the attending physician stopped on the surgical ward to check his patient before he left the hospital. A glance at the patient revealed the sad situation. Emergency measures were instituted with no avail. The student nurse, as a result, left nursing, a career she had cherished since childhood.

Student nurses frequently are reticent in expressing their difficulties because of fear of criticism and the embarrassment they experience in acknowledging their inadequacy. Such obstacles lessen a student's confidence in her own capacity to acquire skill. The student nurse develops a negative attitude toward the postoperative patient and avoids care of this patient whenever possible. These feelings of apprehension and insecurity result in undesirable reactions detrimental to both patient and student.

We believe that provision for skillful supervision of the student nurse's experience in the care of the postoperative patient would eliminate much of the emotional trauma experienced by the student when caring for the anesthetized

patient. The student would, therefore, develop a more wholesome attitude and a feeling of assurance in her ability to handle efficiently any emergency measures that she would be called upon to perform.

The Anesthesia Study Commission of the Philadelphia County Medical Society said in a report, "Bad Training in Anesthesia Deaths Told," that an 11-year investigation of 306 anesthesia fatalities in that area disclosed that 47 percent of the deaths could have been prevented. The highest preventable death rate covered by the report totaled 54 percent and occurred among a group of 97 patients whose preoperative condition was listed as good.[2]

From these statistics, it is evident that the nurse must assume a very important role in the care of the postoperative patient and must, therefore, be given adequate theory and carefully supervised practice in the management of the postoperative patient.

The fact that patients occasionally have gone into shock after returning from the operating room in apparently good condition, has led us to believe that all patients should have the same skillful supervision postoperatively, regardless of their condition on leaving the operating room.

Would the recovery room be the ideal laboratory which would bridge the gap between theory and practice in the care of the postoperative patient? Because of inadequate supervisory personnel on the ward, teaching opportunities frequently are not converted into learning situations.

METHODS OF STUDY

A survey of literature pertinent to the study gave no evidence that previous work had been done in this field. However, the need for nurses better prepared in this aspect of patient care has been mentioned frequently by experts in the field of anesthesia.[3]

Since literature was not available, the study was conducted by means of observation and personal interview, a card questionnaire, and a more comprehensive survey questionnaire. Observations were conducted in four hospitals with an active recovery room service. At each hospital, interviews were held with the director of nurses, and, in three of the hospitals, with the chief anesthetist. Emphasis was placed on securing the following information:

1. Location of the recovery room
2. Administration of the room
3. Types of patients taken there
4. Equipment and facilities available
5. Types of activities performed in the room
6. The existing educational program for the student nurse during her experience in the recovery room.

As the next step, a card questionnaire was mailed to 1,450 hospitals with bed capacity of 100 and over, and 1,000 responses were received. Purpose of this questionnaire was to determine the distribution of recovery rooms and whether there were enough to justify the study.

Finally, a detailed questionnaire was sent to 81 schools of nursing which were connected with hospitals having an active recovery room service. Material in the questionnaire was based on information gathered in the previous steps of the study, as well as on our personal experience in the field. Of the 81 schools polled, 42 responded.

[2]Anesthesia Study Commission, "Bad Training in Anesthesia Deaths Told," **Chicago Daily Tribune**, December 8, 1947.
[3]Lundy, S. A., "Nursing Care as Related to Anesthesia," **American Journal of Nursing**, August, 1944, p. 747.

ANALYSIS OF DATA

Of the 1,000 hospitals replying to the card questionnaire, 129 had a recovery room service. Of these, 81 were connected with schools of nursing. In addition, 239 hospitals reported that they were in the process of developing a recovery room or were planning to establish one. This would indicate an increase in the number of hospitals offering such a service.

Part I of the detailed questionnaire was designed to give information relative to the administration of the recovery room. Of the 42 hospitals participating in the study, 30 had their recovery room service under the control of the nursing school office. This type of relationship would facilitate a program whereby the student nurse gains practical experience in the recovery room.

Part II of the questionnaire was designed to determine how many recovery rooms were located close to operating rooms and to the anesthesia department. The advantage to the student in this arrangement is that necessary emergency equipment not kept in the recovery room, is nevertheless, easily available. Also, availability of the surgical and anesthesia staffs is invaluable to the inexperienced student. The survey revealed that 20 recovery rooms were located on the same floor as the operating room, while 25 were located near the surgical division.

The third part of the questionnaire sought to determine the types of cases for which the recovery room was used. The hospitals were asked to classify recovery room patients according to types of anesthesia used and also according to types of surgery performed. It was found that the majority of patients recovering from general and spinal anesthesia were taken to the recovery room. In addition, varying percentages of patients receiving all other types of anesthesia were reported to use the recovery room.

A survey of the types of surgical cases taken to the recovery room also showed a wide variety. The recovery room was used for practically all types of surgery except obstetrical cases, eye cases, and communicable diseases. From these facts, it is concluded that a rich and varied clinical experience for student nurses exists in the recovery room.

Replies to Part IV of the questionnaire indicated a centralization of equipment and facilities in the recovery room, making possible immediate and efficient patient care.

The purpose of another part of the questionnaire was to discover the activities of various personnel in the recovery room, particularly those of the nurse. It was found that the recovery room nurse is expected to assume most of the responsibility for the patient's care and must have a high degree of skill and knowledge. She must observe and interpret the patient's condition in addition to administering treatment.

AWARENESS OF IMPORTANCE

Answers received from the hospitals indicated an awareness of the importance of having well-qualified graduate nurses in charge of the recovery room. In the majority of the hospitals the graduate nurse had received supervisory experience in a related department. In addition, a number of the graduate nurses had backgrounds in other types of specialized skill or training.

It is suggested that still another prerequisite be placed upon recovery room supervisors. In addition to the required technical skills, the supervisor should be able to recognize student needs in order to provide learning opportunities and guidance for the inexperienced student nurse.

Part IX of the questionnaire pertained to the planned educational activities of students given recovery room experience. In 22 of the 42 schools, recovery room service was given following the student's operating room experience, thus adding another facet to the student's knowledge of the operative patient. The length of recovery room assignment varied from two days to eight weeks. This wide divergence indicates a need for further study to determine how extensive an assignment would actually be adequate.

We also made inquiry into the planned classroom and teaching activities designed to prepare the student in postoperative and postanesthesia nursing. Of the 42 schools in the survey, ward teaching was carried on in 15 and formal classes were conducted in 22. These classes were given as a unit of the surgical nursing course. From these figures it can be seen that classroom instruction is not always correlated with ward instruction.

In 20 of the participating schools, no attempt was made in the theoretical or clinical instruction to prepare the student for the care of patients recovering from anesthesia. However, the figures representing the schools which do provide some form of planned instruction are encouraging.

CONCLUSIONS

Today's hospital planning tries to provide both general and special services for all patients. The recovery room takes its place with other important therapeutic services. Present conditions have been recognized, by those familiar with the care of the postoperative patient, to be far from satisfactory. There has been so much effective agitation of the problem by the anesthesiologists, however, that many hospitals are no longer disposed to ignore the demand for the addition of postoperative observation rooms to their hospital facilities as a means of providing the student nurse with a concentrated period of clinical experiences in the efficient management of the anesthetic patient.

The student nurse needs to become more familiar with every emergency measure which she might be called upon to employ in caring for the anesthetized patient. Her skill in handling the postoperative patient with efficiency and with minimum difficulty will increase the student's confidence in her own ability.

In our study to find out the existing educational value in the assignment of student nurses to the recovery room, the following survey technics were used: Survey of literature, observation and personal interview, card questionnaire, and a detailed and comprehensive questionnaire.

The summary of the most significant findings is as follows:

1. The majority of recovery rooms are under the control of the nursing school office. This finding is contrary to the trend for the anesthesiologists to "assume an increasing responsibility for the postoperative patient."

2. Most hospitals provide for an eight-hour recovery room service. However, some, to meet their needs, have expanded this service to 16 and 24-hour service.

3. The recovery room offers sufficient equipment, facili-

ties, and learning opportunities to provide excellent clinical experiences in the education of the student nurse in postoperative nursing care.

4. The requisite qualifications of the recovery room supervisor vary. However, most hospitals seem to use as a basis for the selection of the graduate nurse in charge, former supervisory experience in the surgical division and in the operating room.

5. The existing educational program offered to the student nurses in the recovery room varies, but it seems that an attempt is being made to utilize the learning opportunities inherent in the recovery room service to enrich the students' clinical experience in the management of the anesthetized patient.

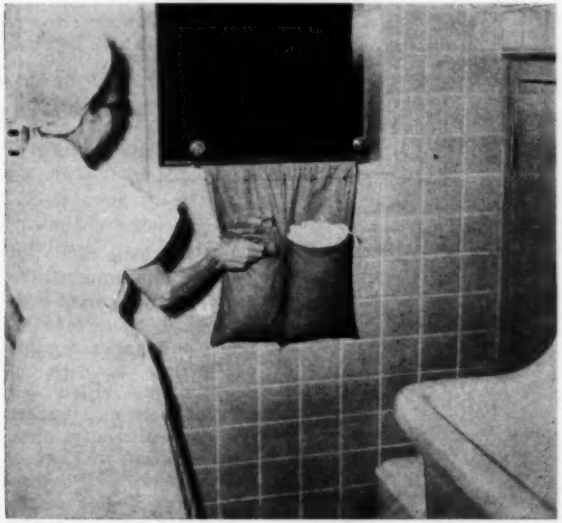
RECOMMENDATIONS

On the basis of our findings, the following recommendations seem to be indicated:

1. That a study be made on two equated groups of students: one group that has had recovery room experience and one that has not, to determine the value of this recovery room experience in the clinical program.

2. That the functions of the registered nurse in charge of the recovery room be studied to determine the definite qualifications and the preparation of the graduate nurse in charge of the recovery room.

3. That a study be made to determine what knowledge of anesthesia is necessary in order to give efficient and adequate postoperative care to patients.



To provide a convenient holder for caps and masks, Rosamond Poole, O.R.S., Providence Memorial Hospital, El Paso, Tex., designed this simple two-pocket bag of green cloth, hung on a suction-cup bar purchased at the dime store. It is placed adjacent to the scrub sinks, just outside the operating room.

It is suggested that still another prerequisite be placed upon recovery room supervisors. In addition to the required technical skills, the supervisor should be able to recognize student needs in order to provide learning opportunities and guidance for the inexperienced student nurse.

Part IX of the questionnaire pertained to the planned educational activities of students given recovery room experience. In 22 of the 42 schools, recovery room service was given following the student's operating room experience, thus adding another facet to the student's knowledge of the operative patient. The length of recovery room assignment varied from two days to eight weeks. This wide divergence indicates a need for further study to determine how extensive an assignment would actually be adequate.

We also made inquiry into the planned classroom and teaching activities designed to prepare the student in postoperative and postanesthesia nursing. Of the 42 schools in the survey, ward teaching was carried on in 15 and formal classes were conducted in 22. These classes were given as a unit of the surgical nursing course. From these figures it can be seen that classroom instruction is not always correlated with ward instruction.

In 20 of the participating schools, no attempt was made in the theoretical or clinical instruction to prepare the student for the care of patients recovering from anesthesia. However, the figures representing the schools which do provide some form of planned instruction are encouraging.

CONCLUSIONS

Today's hospital planning tries to provide both general and special services for all patients. The recovery room takes its place with other important therapeutic services. Present conditions have been recognized, by those familiar with the care of the postoperative patient, to be far from satisfactory. There has been so much effective agitation of the problem by the anesthesiologists, however, that many hospitals are no longer disposed to ignore the demand for the addition of postoperative observation rooms to their hospital facilities as a means of providing the student nurse with a concentrated period of clinical experiences in the efficient management of the anesthetic patient.

The student nurse needs to become more familiar with every emergency measure which she might be called upon to employ in caring for the anesthetized patient. Her skill in handling the postoperative patient with efficiency and with minimum difficulty will increase the student's confidence in her own ability.

In our study to find out the existing educational value in the assignment of student nurses to the recovery room, the following survey technics were used: Survey of literature, observation and personal interview, card questionnaire, and a detailed and comprehensive questionnaire.

The summary of the most significant findings is as follows:

1. The majority of recovery rooms are under the control of the nursing school office. This finding is contrary to the trend for the anesthesiologists to "assume an increasing responsibility for the postoperative patient."

2. Most hospitals provide for an eight-hour recovery room service. However, some, to meet their needs, have expanded this service to 16 and 24-hour service.

3. The recovery room offers sufficient equipment, facili-

ties, and learning opportunities to provide excellent clinical experiences in the education of the student nurse in postoperative nursing care.

4. The requisite qualifications of the recovery room supervisor vary. However, most hospitals seem to use as a basis for the selection of the graduate nurse in charge, former supervisory experience in the surgical division and in the operating room.

5. The existing educational program offered to the student nurses in the recovery room varies, but it seems that an attempt is being made to utilize the learning opportunities inherent in the recovery room service to enrich the students' clinical experience in the management of the anesthetized patient.

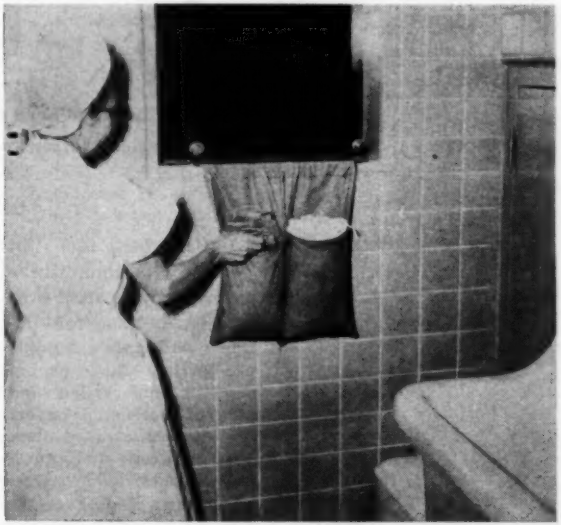
RECOMMENDATIONS

On the basis of our findings, the following recommendations seem to be indicated:

1. That a study be made on two equated groups of students: one group that has had recovery room experience and one that has not, to determine the value of this recovery room experience in the clinical program.

2. That the functions of the registered nurse in charge of the recovery room be studied to determine the definite qualifications and the preparation of the graduate nurse in charge of the recovery room.

3. That a study be made to determine what knowledge of anesthesia is necessary in order to give efficient and adequate postoperative care to patients.



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Recovery Unit Improves Care

By Mrs. Ethel I. West
Operating Room Supervisor
Methodist Hospital of Southern California
Los Angeles

Mrs. West

IT HAS long been felt that the immediate postoperative period was a critical time for patients, and that during this period they should be under the supervision and care of personnel expert in postanesthesia training. The surgeon and anesthesiologists, who necessarily are limited as to actual time spent with the patients following surgery, thus would be assured that the patient was receiving efficient nursing care. The responsible persons would be notified if progress was not satisfactory.

The recovery unit at the Methodist Hospital of Southern California, established to better meet present-day needs, is situated directly adjacent to the operating rooms. Its purpose is to give improved care to patients during the immediate postoperative period. Patients requiring the same kind of nursing care are concentrated in one nursing area where nursing time and special equipment are more efficiently utilized. Patients in various stages of recovery are not seen in corridors, elevators, or multiple areas.

The anesthesiology staff, in cooperation with the medical staff, has primary responsibility for the over-all management and coordination of the medical aspects, with the chief of anesthesia as coordinator. The nursing personnel become highly specialized in this phase of patient care and concentrated service without interruption, and the anesthesiologists and other members of the medical staff are nearby to give close supervision or any necessary emergency care.

STAFFING

The unit is a separate division of the department of nursing service, and is under the over-all supervision of the operating room supervisor, with a head nurse in charge of the unit. At present, it is staffed according to the needs of the department, and also to include training of professional and vocational students.

We have proved the following advantages in having the recovery room adjacent to the operating rooms:

- The anesthetists, or other members of the medical staff, are easily available for emergencies. We have had two such cases. In both instances, the patients hemorrhaged, and without delay were wheeled directly into surgery for emergency treatment.
- The operating room orderlies assist in transferring patients to and from the recovery unit.
- Linens are supplied by surgery, and sterilization of supplies is done by the operating room staff, thus eliminating the need for additional personnel to perform these duties.

Patients are transferred from the operating room table to special carts provided by the recovery unit and remain on these carts until they are transferred to their room beds. Children must be in *cribs*—not on carts.

In general, all postoperative patients, unconscious from a general anesthetic, are transferred to the recovery unit until they have reacted and become stabilized.

THE EXCEPTIONS

Patients go directly to the wards from the operating room when the maximum number of patients in the recovery unit would be exceeded, and none in the unit can be transferred out, or when they are:

1. Patients from the obstetrical division, including newborns
2. Surgical cases considered contaminated and treated as such in the operating room
3. Local anesthesia patients
4. Spinal anesthesia patients, except those who are unconscious from combination types of anesthesia
5. Selected cases, according to doctor's preference, in which it is better to move patients to their beds while unconscious
6. Patients with radium

However, any patients requiring close supervision following surgery are admitted to the unit.

Special nurses are allowed to care for their patients in the unit under the supervision of the recovery room personnel.

Priority in the unit is determined by the operating room supervisor according to the best interests of all patients, with the approval of the chief of anesthesiology.

Transfer out of patients is authorized by the anesthetist or attending surgeon. Orders for transfer may be verbal or by telephone.

No visitors are allowed in the unit, unless the patient's condition is critical. On such occasions, clergy, close relatives, and friends may be permitted to see the patient in a private room in the unit kept for this purpose.

An emergency buzzer connected in surgery brings prompt response for aid.

NO ADDITIONAL CHARGE

No additional charge is made for recovery room service to patients, except for extra drugs and treatments that are not included in the usual care of patients. The cost of operation of the recovery room unit is absorbed by the surgical nursing department. We feel that this has been justified because the unit helps to stabilize nursing service. It not only benefits the patients in the unit requiring immediate postoperative care, but provides decreased interference in the routine care given to the patients on the divisions.

Before the patient enters the hospital, his immediate family is advised of the care and treatment he will receive in the recovery unit. This practice lessens fear and anxiety of the patient and also reassures the family that he is receiving special care.

FACILITY AND EQUIPMENT

The unit contains two patient areas, with the desk situated so that all patients are under constant observation. The medication cupboard, counter, emergency locker, and alarm buzzer are easily accessible to all patient areas. All lockers, cupboards, etc., are built in, leaving adequate floor space for easy moving of carts and for essential equipment in patient areas.

The work area is recessed to reduce annoyance of utensil and activity noises to patients.

Recovery carts have free turning wheels, two with lock brakes to stabilize carts while in the unit. Mattresses are covered with moistureproof, conductive material. Removable side rails are stored on the lower framework of the cart when not in use. Carts also are equipped with two safety belts, an I.V. standard, and shoulder braces. The only manual lift on the cart is at the head to place the patient in upright position. The foot of the cart may be cranked to tilt the patient in any modification of shock position in a matter of seconds.

TRANSFER OF PATIENTS

A crank on the side of the cart operates the duo-gear mechanism that moves the cart bed horizontally over the patient's bed, and continues to a 45° angle. Then three persons transfer the patient to his own bed with minimum effort. This method of transferring patients on the recovery carts has decreased the number of back injuries to personnel as a result of lifting.

Other equipment consists of:

Electric sterilizer
Gomco and Connell suctions
Barton spotlight
Dressing cart
Oxygen equipment
Drainage and irrigating sets
Emergency drugs
I.V. solutions and Vaco sets
Catheterization equipment
Refrigerator containing crushed ice for oxygen therapy, ice collars which are filled, ready for use
A work area, complete with waste hopper, scrub sink, linen hamper, etc.

METHODS AND PROCEDURES

Patients are received from 7 a.m. to 4:30 p.m., and length of stay in the unit is determined by the anesthesiologist in charge of the case.

On admission, the patient is checked in with the anesthetist who accompanies him to the unit. The anesthetist makes periodic checks on the patient during his stay and is called for special checks at the discretion of the charge nurse. The surgeon on the case visits the patient as soon as possible after admission.

ROUTINE PROCEDURE ON ADMISSION

Check:

1. Airway—mechanical and natural
2. Color of skin
3. Respiration—character and quality
4. Pulse—character and quality
5. Blood pressure (check admission and surgery course)
6. Capillary refill
7. Condition of skin
8. State of reactivity
9. Retention catheters, drain tubes, gastric tubes, etc.
10. Dressing, drains, drainage

POSTOPERATIVE ORDERS

Blood pressure cuff is adjusted to arm, a reading taken, and a verbal report made to the attending doctor. There is a cuff for each chart.

Blood pressure, pulse, and respiration are taken routinely every 15 minutes during stay, or more often if condition warrants closer observation.

Arms or feet getting I.V.'s are stabilized with gauze ties.

Retention catheters are checked, and if so ordered, are connected to drainage bottles at once.

Dressings are checked. If any drainage is present, size, character, and color are noted and charted.

ROUTINE ON DISCHARGE FROM UNIT

Patient is checked to see that he has:

1. Full orientation
2. Normal respiration
3. Suitable circulation
4. Blood pressure stabilized
5. No excessive bleeding, drainage, or discharge from operative site
6. Adequate drainage from retention catheters, drain tubes, gastric tubes.

On the patient's admission, his respective floor is notified of his arrival and general condition. If there is a drastic change in condition, the floor is notified.

If length of stay is predetermined and over three hours, the floor is given a condition report at mid-time. Example: Spinal fusions and laminectomies are routinely kept in the unit five hours, if possible; the floor is given a report in three hours. G.U. and urology cases are kept at least three hours.

Each patient is logged in on the unit daily record sheet. Room and bed number, name, surgeon, anesthetist, operation, anesthetic, and times of admission and discharge are noted.

Unit records include:

1. Patient's recovery sheet, which becomes part of permanent chart
2. Unit daily record sheet

3. Monthly report, which gives briefly the total number of patients, minimum and maximum time in unit, earliest arrival time, latest discharge time, average patient time in unit.

ADVANTAGES OVER OLD METHOD

We have found the following advantages to the patient in this method:

1. Constant specialized observation
2. Immediate availability of anesthesiologist and surgeon
3. Close proximity to surgery
4. Quiet, calm surroundings
5. Patient's feeling of security, safety, and assurance, resulting from immediate response of nurses when he requests attention
6. Immediate attention to emergency situations
7. Concentrated nursing service with specialized observation

Since our recovery unit has been in operation, valuable information has been verified in regard to care of post-anesthesia patients, such as the fact that positioning of patients influences blood pressure. From these studies, the surgeon is aided in the treatment of the patient after he leaves the recovery unit.

Physical Layout of the Recovery Room

Harriet B. Smith, R.N.
New York Hospital
New York City

MUCH progress has been made in patient care in recent years, but probably nothing is of more interest or of more vital concern to us in anesthesia than the organization of the postoperative recovery room. Our responsibility does not cease the moment the patient leaves the operating room. The anesthetist's responsibility begins the minute anesthesia is administered and does not end until the patient's blood pressure, pulse, and respiration are stable; until he has completely recovered his reflexes, and is fully awake and oriented.

There is no more dangerous or more crucial time in a surgical patient's hospitalization than the immediate postoperative, postanesthesia period. A few statistics will verify this statement. In an article by Dr. Lowenthal on "Recovery Room: Life Saving and Economical," in the July, 1951 issue of *Anesthesiology*, it was reported by the Philadelphia Anesthesia Study Commission[1] that over an all-year period, there were 306 deaths related to anesthesia. Nearly half of these were classified as preventable, and 95 (or 63 percent) were the result of a combination of inadequate nursing care and respiratory obstruction.

Since similar results have occurred or are now occurring elsewhere, it is understandable that many hospitals are solving the problem by the organization of the postoperative recovery room.

Some advantages of a recovery room unit are:

1. Mortality and morbidity are decreased because such complications as respiratory obstruction, hypotension, hypoxemia, shock, and hemorrhage are prevented or recognized and treated immediately by trained and competent personnel.

2. Improved nursing care is given with a minimum of risk to the patient. Recovery room personnel usually are under the direct supervision of the anesthesiology department. They are especially trained to recognize and cope with the many emergencies arising in the immediate postoperative period.

3. The anesthetist and surgeon are always available if emergencies arise, and they may observe patients routinely between cases or as frequently as necessary.

4. With centralization of the postoperative patients in one area, fewer nurses are needed, and the amount of equipment required is less than if it had to be duplicated in several hospital areas.

5. Postoperative accidents, resulting from long transit from the operating room to the patient's room, are avoided.

6. Recovery room units lessen the work load and confusion on a busy surgical floor.

7. Other patients, as well as relatives and friends, are relieved of distressing sights and sounds sometimes associated with emergence from anesthesia.

8. Finally, the morale of patients and relatives is strengthened by the knowledge that the postoperative patient is under the constant care of skilled nurses, with the anesthetist and surgeon nearby.

Physical layout in the postoperative recovery room may be divided into several categories. The following discussion describes what we consider an ideal set-up. Many recovery room units vary in size, arrangement, and equipment, with equally good over-all results. Therefore, any attempt to organize and maintain a recovery room should be seriously considered and encouraged. Experience has proved that the results will be gratifying.

The location of the unit is most important. It should be on the same floor, and adjacent to, the operating room suite. This arrangement permits minimum postoperative transportation of the patient and insures prompt postoperative care and treatment.

The size of the unit depends on the maximum number of patients to be accommodated at one time. The following ratio, which takes into account the total number of hos-

[1]Presented by Ruth, Haugen, and Grove at the annual meeting of the Southern Society of Anesthesiologists, St. Louis, April 1, 1950.

pital beds, operating rooms, and operations per day, has been worked out:[2]

1-4 O.R.'s require 1 R.R. bed/per O.R. plus 1
5-8 O.R.'s require 1 R.R. bed/per O.R. plus 2
9-12 O.R.'s require 1 R.R. bed/per O.R. plus 3

In other words, a 200-bed hospital, utilizing five operating rooms, averaging 20 operations per day, should maintain seven recovery room beds.

Many different factors enter into the actual setup of the recovery room unit. It should consist of one open ward with curtains to afford privacy for the conscious patient.

There should be a utility room plus ample cupboard and storage space for linens, medications, and equipment. In one end of the unit, there should be a glassed-off cubicle to accommodate the infectious cases.

Doors should be wide enough to permit the entrance of beds with special apparatus attached. Sufficient space around each bed (or stretcher) is very necessary. At times it must accommodate bulky equipment and allow personnel to move freely on all sides. A minimum of four feet between beds is recommended.

Conductive floors are necessary if the recovery room is adjacent to the anesthetizing area. Soundproofing of the room is recommended to minimize noise.

UNOBSTRUCTED VIEW OF PATIENTS

A most important factor is unobstructed visibility of patients from the work stations and nurses' desk. Therefore, the utility room should either be glassed off or have a large observation window.

Adequate lighting facilities must certainly be emphasized. We in anesthesia know the importance of good lighting in observing the patient's color or in detecting the slightest sign of cyanosis. Natural lighting is best. When artificial lighting is used, the indirect method is preferable. Some means of emergency lighting should be available. Electrical wiring should consist of one duplex outlet for each bed plus one heavy duty outlet in the unit for x-ray equipment.

Communication systems, besides the telephone, should include one or more emergency call buttons between the recovery room unit and the operating room suite. Individual call bells are not necessary.

Oxygen and suction must be available for each bed. The oxygen may be piped from a central supply or a manifold system adjoining the unit, according to the recommendations of the National Fire Protection Association. In many hospitals portable equipment is used instead of a central supply. If piped oxygen and wall suction are used, it is recommended that the outlets be placed 5′ 3″ high. Both should be gauge-controlled, with the suction and humidifier bottles fastened to the wall.

Air-conditioning is highly desirable, particularly if the operating rooms are air-conditioned. The temperature should be maintained around 72°, with 40-50 percent humidity.

The recovery room should have adequate plumbing facilities, including hot and cold running water for hand

[2]Galbraith, T. P., and Schafer, M. K., "Recovery Room Services—a Guide for Planning," **Hospitals**, Vol. 26, No. 11, November, 1952, pp. 65-77.

washing in the patient area. The utility room should have a double sink and sterilizer for cleaning equipment, as well as a bed pan flusher and disposal units for excreta.

At the New York Hospital-Cornell Medical Center we have been operating a 16-bed recovery room unit for over three years. It consists of five rooms, a utility room, and an office, with three of the rooms connected by open doorways. One single room is kept for contagious cases.

The recovery room operates on a 24-hour basis with personnel including one supervisor, one head nurse, six staff nurses, one nurse's aide, two orderlies, and one floor clerk.

PORTABLE SUCTION MACHINES

We use portable Sorensen suction machines (one to each two beds) and portable McLellan suctions for Levine tube aspiration. By each bed there is a "G" tank of oxygen with a meter gauge and an O.E.M. mask and bag for delivering the oxygen. A positive pressure oxygen mask is available for emergencies, and an Emerson respirator is kept in the unit at all times.

Two mechanical bed lifts, in addition to several wooden platforms, are used for placing beds in Trendelenberg position.

The unit is air-conditioned.

All patients receiving general or spinal anesthesia are returned to the recovery room in bed. One exception is made, as the intraocular surgical cases are returned directly to the eye service. Approximately 45-50 patients are cared for in the recovery room daily.

A postoperative recovery room can operate efficiently only through the closest cooperation of the surgeons, the anesthetists, and the surgical nurses.

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The A.O.R.N. Problem Clinic

Questions and answers on common operating room problems*

MODERATOR: Elliott Hurwitt, M.D., Chief of Surgical Division, Montefiore Hospital, New York City

Participants:

SURGEON: Cyril Costello, M.D., Medical Director, City Hospital, St. Louis

ANESTHESIOLOGIST: Seymour Brown, M.D., Chief, Department of Anesthesia, St. John's Hospital, St. Louis

ADMINISTRATOR: William H. Andrews, Administrator, Peoples Hospital, St. Louis

DIRECTOR OF NURSES: Anne Campbell, R.N., Director of Nurses, Barnes Hospital, St. Louis

OPERATING ROOM SUPERVISORS: Capt. Margaret J. Whitton, ANC, U.S. Army Hospital, Fort Leonard Wood, Mo., and Mrs. Frances F. Ross, Former Operating Room Supervisor, John Gaston Memorial Hospital, Memphis, Tenn.

OPERATING ROOM INSTRUCTOR: Mrs. Sarah Marks Giddens, R.N., Operating Room Instructor, Lincoln Hospital, New York City

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DR. HURWITT: Most of our questions are for the operating room supervisors. Here's the first one: Is it approved technic for O.R. scrub nurses to wear nail polish when operating? Also, should surgeons wear wedding rings during operations? Mrs. Ross, could you answer those questions?

MRS. ROSS: No, to both questions.

DR. HURWITT: Next question, for Capt. Whitton, is: What is your opinion on O.R. nurses being sent to various departments in the hospital to relieve?

*Transcript of a panel discussion from the Second National Conference, Association of Operating Room Nurses, St. Louis, January 24-27, 1955.

CAPT. WHITTON: Only in a case of emergency would I suggest that O.R. personnel be taken from their department to go to other parts of the hospital.

DR. HURWITT: Here's a question for a surgeon: How do you persuade doctors to use new technics when they insist the old way has always served—so why change?

DR. COSTELLO: I would suggest that nurses not try to get surgeons to change their technics. Surgeons are supposed to be authorities on these themselves.

DR. HURWITT: Dr. Costello, suppose that they are not concerned with the technic of how you do a gastric resection but rather with scrubbing technics and changing from old-style soaps to new style soaps, and old-style gowns to new-style gowns and things like that?

DR. COSTELLO: I misunderstood the question. I suppose the best approach is to have exercises for the surgical staff. This training should begin with medical students in the operating room and be extended to the house staff. Some of the older surgeons, older in experience, perhaps, are the most difficult to get to change their habits. But I think changes have been accomplished generally through staff education, in which the operating room nurse and the chief of surgery must take the initiative.

DR. HURWITT: Here's a question for the anesthesiologist: In our hospital we have the problem of the anesthesiologist leaving the room during surgery. Do you think this should be done? How can we stop it? Dr. Brown!

DR. BROWN: To the first part of this question, absolutely not! It should not be done because one of the integral functions of an anesthesiologist is to observe his patient carefully at all times. As to the second part of the question, I think that one would have to go through a so-called chain of command: talk with the surgical supervisor and then proceed to the chief of surgery. Unfortunately, this action casts some aspersions on the man's conduct of his anesthesia, and he will have to justify himself.

DR. HURWITT: We have a question for the administrator. Mr. Andrews, who should schedule the surgery in a 100-bed hospital in which there is a medical anesthesiologist—the O.R. supervisor or the anesthesiologist?

MR. ANDREWS: I would think that in a hospital of 100 beds or less the O.R. supervisor should schedule all operations.

DR. BROWN: I have to disagree with that. I feel that in order to achieve a smooth-running organization, one must have close cooperation between the anesthesiologist and the O.R. supervisor. It's necessary to realize what the responsibilities of the anesthesiologist are as far as the administration of anesthesia is concerned. I think that he would have a better idea as to how long it would take someone to do a certain procedure and therefore could determine the availability of personnel for anesthetizing the patient, because you're not going to proceed with the operation until the anesthesia has been given.

DR. HURWITT: Miss Campbell, do you think operating room staff nurses should be paid more than general duty nurses? If so, how much?

MISS CAMPBELL: No, I don't believe that operating room nurses should be paid more than general duty nurses, unless they have had special training. I think that special training and education should of course bring them salary increases. If they are on call, they should be paid for calls, but I do not believe they should be paid more for the actual work that they put in during the day.

DR. HURWITT: Mrs. Ross, should the operating room nurse be allowed out of the operating room unit in scrub dress and turban? If so, where?

MRS. ROSS: No, she should not leave the unit.

DR. HURWITT: Here's a question for the operating room instructor: Is there a desire and a need for additional postgraduate courses in O.R. management throughout the country? Capt. Whitton!

CAPT. WHITTON: I couldn't answer that question correctly for the civilian nurses—but in the Army we do have a tremendous program for the Army personnel who desire operating room work.

DR. HURWITT: Miss Campbell, do you have anything to add?

MISS CAMPBELL: According to the number of inquiries that come to our graduate program at Washington University, I would say yes. I think there are many nurses who are interested in more postgraduate work in the operating room. We do not have such a course, and I think it's difficult to find one throughout the country. We have had numerous requests for nurses for operating room supervisors and trained operating room nurses.

DR. HURWITT: Could you tell the group here where they could get information about such courses?

MISS CAMPBELL: No, but I think they could find out by writing to the National League for Nursing.

DR. HURWITT: Mrs. Ross, should surgery caps be worn in the O.R. at all times—such as when doing clean-up work?

MRS. ROSS: Auxiliary personnel usually do the clean-up work. I do not think it's necessary for them to wear turbans. However, they should wear nets, and I don't believe they should have long flowing hair.

DR. HURWITT: To get back to the anesthetists again, what technic should be used in prepping a patient for spinal anesthesia? Should the one scrubbing the patient's back scrub and wear rubber gloves?

DR. BROWN: I believe that the person scrubbing the patient's back need not necessarily wear rubber gloves. I state this from the standpoint of personal experience, having given many hundreds of spinals in which we have rarely used rubber gloves. We've used various different technics, employing Zephiran, Septisol soap and Phisoderm, and have yet to see resultant infection.

Unless there is a very large amount of hair, we do not routinely shave the patient's back. I feel more trauma is done in that regard than in the puncture.

Panel members (standing, l. to r.): Dr. Brown, Captain Whitton, Mr. Andrews, and Dr. Costello. Seated (l. to r.): Mrs. Ross, Miss Campbell, and Mrs. Giddens. Session has been most popular one at first two A.O.R.N. conferences.

DR. HURWITT: Here's a question for the operating room instructor: Capt. Whitton, what is the simplest and safest procedure to follow in dirty cases?

CAPT. WHITTON: We do not, in our hospital, permit anything or anyone to leave the operating room when we have a dirty case. All linen, all instruments, and anything that has been left in the room are autoclaved immediately. We have someone outside the room with an extra laundry bag. All equipment is put into this container and taken directly to the empty autoclave. The room is then washed down by the personnel who have been in the room—the corpsmen and the scrub nurse. They do not at any time leave the room until everything is cleaned.

DR. HURWITT: Mrs. Giddens, what do you do at Lincoln Hospital?

MRS. GIDDENS: We follow the same method. All the instruments that have been in the room are autoclaved. We wash, in Lysol, the instruments that have been in actual contact with the patient, and then they are autoclaved. The soiled linen is sent to the laundry separately; the unsoiled linen is put in the autoclave.

DR. HURWITT: Now, back to anesthesia again: Should the type of anesthesia be discussed with the patient before he is on the operating room table, Dr. Brown?

DR. BROWN: An integral part of the practice of anesthesiology is the preoperative visit to the patient. It's a very important part of the administration of the anesthesia. I not only go to the patient, I get his history. If he hasn't had a previous physical examination, I do it. I note any kind of anesthetic history as well as any surgical experiences or allergies. If the patient shows an interest in the type of anesthesia he is going to have, I discuss it with him. I do not go around to him as with a case of samples and say, "We have all these various types—what type would you like?" But if he shows any interest, I discuss it fully with him. If there's any disagreement, I also clarify that. I give the type of anesthesia which I feel is safest for the patient, whether he chooses it or not.

DR. HURWITT: Here's a question for Miss Campbell: Is there any rule or formula to determine the number of personnel necessary to run an operating room—graduates, students, technicians? For example, suppose you have 200-225 case loads per month, three operating rooms, and an infrequently used GU room?

MISS CAMPBELL: I think the first thing you have to determine is the type of cases you have, the type of surgery you do—whether you have urological surgery, chest surgery, major abdominal surgery—before you can definitely determine the number of nurses you will need for the number of operations that you do per month. At Barnes Hospital we try to have two nurses to take care of each room. In the room where we have the neurosurgical patients we have three nurses.

Surgery today certainly requires more nursing service and more skilled personnel than surgery many years ago.

DR. HURWITT: Let's see how the Army handles this. Capt. Whitton!

CAPT. WHITTON: We have four nurses, including the supervisor. We have from 12 to 14 enlisted men, and we do on the average of close to 300 cases a month. So we can assign the steady personnel to whichever room we want. We try to assign enlisted men to each room for one month. They are entirely responsible for the rooms, under the supervision of the nurse.

I think it would be rather hard, if you're going to have a neurosurgical case, to run out and get another nurse because you have a little more work to be done. I didn't quite understand the answer we received there.

DR. HURWITT: Are there any others on the panel who have more fixed ideas about distribution of personnel in the O.R.?

DR. COSTELLO: Dr. Hurwitt, I would say that there is another factor that must be considered in comparing statistics or working out a program from these recommendations and others—and that is the time consumed by the surgeon in operations. For some procedures perhaps the average operating time across the country could be determined. However, some operating rooms might be more completely utilized by surgeons who take considerably more or less time than the average. Even more important than this factor is whether or not you are spending interest and time in a teaching program.

In a hospital doing work entirely on visiting staff level, the operating room schedule moves more rapidly and requires fewer personnel, since their procedures are completed earlier and more time can be devoted to preparation for that evening or the next day.

In the teaching institution, however, where both undergraduate and postgraduate students may be performing part of the work or assisting in it, more time will be consumed and more personnel will be required.

DR. HURWITT: Dr. Costello, when should the surgeon appear if his case is scheduled for 8 a.m.?

DR. COSTELLO: The surgeon should appear in the operating room 15 minutes or more before his case is scheduled to begin. I do not mean in the hospital, but actually in the operating room. He should allow time to see the patient and inspect the record, to be sure that nothing has occurred during the night or since the patient arrived in the operating room that might influence the decision on operation.

DR. HURWITT: What can you do about the man who doesn't show up on time?

DR. COSTELLO: I'd like to pass that question to Dr. Brown, who works with Sister Mary Anselm at St. John's Hospital. They have not only satisfactorily answered the question in practice at their hospital, but have also demonstrated a good pattern for cooperation between supervisor and anesthesiologist. It's difficult for a nurse to direct a surgeon, particularly at visiting staff level, although by default she may be put in this administrative role.

Interns and house doctors frequently are gratified for the experienced advice which they obtain from the operating room supervisor. The visiting staff surgeon, however, when receiving too many orders and directions from the nursing supervisor, rebels. So the fact

is that the hospital administrator or the operating room supervisor is in a difficult position in making demands on visiting staff physicians. These staff regulations really belong in the hands of another physician who is given the authority for enforcement. And I think that person should be the chief of surgery, chief of staff, or particularly the anesthesiologist, who has had a great deal to do in obviating this sort of thing.

DR. HURWITT: Dr. Brown, do you think the anesthesiologist should be in a position to discipline staff surgeons who are late?

DR. BROWN: It's not a question of discipline in the absolute sense. There are many different ways of discipline. One is to chide by pointing out the actual errors and then the dangers of arriving late for the operation. The inconvenience is not only to the surgeon but to the men who follow him on the schedule. He should feel that he will be in a position at some other date to follow other people.

We have another way of handling the situation without directly disciplining the surgeon, which, of course, is necessary after two or three occurrences. When a man is late after a couple of times and we have a good number of cases on our operating room schedule, we just shift another case in his place, and make him wait an hour or two. It's amazing what practicality will do to a man's realization!

DR. HURWITT: Of course you're penalizing the patient when you do it that way, aren't you?

DR. BROWN: Not necessarily, because if a man has so little thoughtfulness that he has allowed the preoperative medication to lapse beyond the usual time, we can replenish it intravenously. Thus the patient is still more or less in an optimum condition when we do start.

DR. HURWITT: I'm beating this into the ground, but this is a very important question. Suppose the man's late for an operation that you know is going to take him three or four hours to do. He's scheduled for a subtotal gastric resection for 1:30 in the afternoon, and he doesn't show up until 2:15. Are you going to let him start that case at 2:30 and keep your whole O.R. staff around till 6 o'clock?

DR. BROWN: There again, we'll have to consider personal factors. There are men who are practically always on time, and there's always the emergency. The only time one can even think about any discipline or measures of retaliation is when a person is consistently late. If the situation you describe involves a man who is rarely late, I think it is only fair to cooperate. But if the man has been consistently tardy, then his case should be cancelled.

DR. HURWITT: And the patient is the one who suffers for what's done. Let me give the question to Mr. Andrews, because it was actually directed to him. What can be done with the surgeon who is late, without notifying the O.R. staff? We're now talking about the habitually late surgeon.

MR. ANDREWS: I think if a man is consistently late his tardiness reflects on the hospital. I think it's up to the administrator to go through the staff, through the chief of surgery, and have a talk with this particular man, and try to find out why he is consistently late.

But I do not feel that a lay administrator, like myself, should go directly to the surgeon.

DR. HURWITT: This is a very serious problem throughout the country. If a case doesn't get started on time, not only is that room thrown off, the whole schedule is thrown off, the whole hospital is thrown off, mostly due to the thoughtlessness of one person. While there are emergencies—and particularly in the New York area it's very possible to come out and find your car hemmed in by three or four trucks, so that you are delayed—these are infrequent.

In our hospital, when a person is late for the first time, I have a little chat with him. When he's late for the second time, I have another chat with him, which includes a warning that on his third offense he will be deprived of his operating room privileges for a period of a month, and that if the offense is repeated a fourth time we will seriously consider separating him from the hospital.

Now this method is rather drastic, but I think the problem calls for this kind of maneuver. In order to make such a program "stick," it has to apply equally well to the most senior man on your staff as well as to the most junior man. You cannot make an example of or penalize somebody who's just finished his residency when the attending surgeon on a specialty service or the chief of the division himself commits the same offenses. Don't make such a rule unless you have to, but if you do make it you have to make it stick for everybody.

Capt. Whitton, here is the same problem at your level: Do you have any suggestions for handling nurses who are habitually late?

CAPT. WHITTON: The only thing we do is to have them stay on duty a little longer. After all, in the Army they're not deducted for being late. But we have so little trouble with that problem that we don't worry about it. Everyone, I believe, oversleeps occasionally —but we shouldn't let it happen too often.

DR. HURWITT: Mrs. Ross, what do we do in civilian life?

MRS. ROSS: The operating room supervisor should work with the nursing staff, so that if one nurse is consistently late the supervisor can discuss the problem with her and expect her not to be late any more except in an emergency. If that nurse is always late, then she probably has other persistent faults too. There are some nurses who just don't fit into the operating room. A good operating room nurse will be punctual. If a nurse is late over and over, she should be replaced.

DR. HURWITT: This question is directed to Miss Campbell, but I think she may want to pass it on. Let me preface it with this question: Miss Campbell, do you

think that the nursing administrator or the operating room supervisor should schedule the cases?

MISS CAMPBELL: I think that the operating room supervisor, with the cooperation of the anesthetist, should schedule the cases.

DR. HURWITT: Then, Mrs. Ross: In regard to elective surgery, how late do you schedule your last case?

MRS. ROSS: Of course that's up to the individual operating room. At our own hospital we stop operating at 5 o'clock. I must explain that ours is a teaching hospital, and we have students of all types. Our scheduling is very different from the private hospitals. If at 4 o'clock we have a radical mastectomy to do, we know we can't finish by 5, so we cancel. If we have a small operation, such as an excision of a lipoma, which we can finish by 5 o'clock, we do not cancel.

DR. HURWITT: Mrs. Ross, will you comment on the scheduling of emergency operations after the surgeon's office hours.

I presume that the questioner means that an emergency has come up and there's time available, and the surgeon says, "Well, I'll come up when I finish my office hours."

MRS. ROSS: I think that the operating room supervisor cannot make all these decisions alone. If she can work with the anesthetist and the chief of surgery, they can form a committee to solve all these problems and form definite policies. The committee can support her decisions. If policies are written down in black and white, then she can say, "This is it," and make no personal differences at all. We all know that we may like a certain surgeon and we don't want to interrupt his office hours because we want him to see all the patients that he can. Yet we cannot say, "All right, we'll just stay here and wait for you," because if we have a vacancy and he needs to do that emergency, then certainly I feel he should utilize the time available.

DR. HURWITT: Of course, there are emergencies and emergencies. There are the emergencies that have to be done "stat," and there are those that require a few hours of preparation on the part of the patient before the surgery should be done, and there are the cases that should be done within the next few hours but shouldn't wait until the next day. I think you're pretty much dependent on the judgment of the surgeon as to the character of the emergency that he's handling.

Here are two questions for Mr. Andrews, both about a recovery suite. The first is: Who should be responsible for the recovery room? Should it be under the O.R. supervisor, or should it be a separate department with a department head?

MR. ANDREWS: I'm not really in a position to answer that question fully, because I do not have a recovery room in my hospital. But I believe it should be a separate department headed by the anesthesiologist.

DR. HURWITT: Here's the second question before I go back to that first one, because I think that will stand some discussion. Should the patient be charged for the use of the recovery room? Do you feel this works a hardship on him, and how could one eliminate this procedure?

MR. ANDREWS: I do not feel that the patient should be charged, because I think the primary reasons for the innovation of a recovery room are to help solve the nursing shortage and to relieve the surgical nurse from having to take care of the postoperative procedures. I think the unit really is a convenience for the hospital.

DR. HURWITT: There's no question that it is a great convenience for the hospital and effects a great saving in personnel all around. At our hospital, where we have a really first-class recovery unit, there is a charge for the private patient who does not have a special nurse. The charge is $1.50 an hour, which by the time the month is over just about balances out the running of the recovery unit. The ward cases of courses are not charged, and the cases who come in with their special duty nurses are not charged.

I'd like to go back to the first question and toss it to Dr. Brown, but first let me ask you, Dr. Brown, is anesthesia a separate department in your hospital, or is it under the chief of the surgical division?

DR. BROWN: We are considered a part of the surgery division, but there's never been any interference in anything I wanted to do as head of the anesthesia department. If there is anything at all that might be debatable, I discuss it with the chief of surgery ahead of time.

DR. HURWITT: Now who do you think should be in charge of the recovery unit?

DR. BROWN: I feel that the anesthesiologist should be in charge of the medical aspects of the recovery room, and that either the director of nurses or the O.R. supervisor should be in charge of the nursing aspects, under the direction of the anesthesiologist.

I feel that the unit is not purely a convenience for the hospital personnel. That was not the original idea, and I don't think as far as the patient is concerned that it is a hospital convenience. It's an actual safety measure; it's a better form of treatment. I think that we should not lost sight of this fact.

DR. HURWITT: Our recovery room is run nursing-wise not under the supervision of the operating room supervisor, but under its own supervisor, who functions as a unit under the surgical supervisor, who functions under the director of nurses.

Our department of anesthesia is in the surgical division, and the anesthetist and the surgeon share in the professional responsibility for the recovery unit. No patients can leave the recovery unit without having been seen and signed out by a member of the anesthesia or surgical departments.

Here's a question for Dr. Costello: How do you differentiate between major and minor procedures? Does the procedure itself, the surgeon, or the length of time involved, have any bearing on the category?

DR. COSTELLO: I don't know that this question can be answered. Those who have studied it at length, because they're interested in the economic aspect of medicine, have not been able to elucidate it completely. What may be a minor operation so far as technic or time is concerned may be major because of a coincident illness, whether it be diabetes, heart disease, or some-

thing else. I don't know exactly what facet of the problem prompted the question. Ultimately the decision as to whether surgery is major or minor must rest with the surgeon.

DR. HURWITT: I think that probably some hospitals have their operating room charges based on categories such as this.

DR. COSTELLO: For information on this subject, I think that one can refer to the Blue Shield, which has made perhaps the best study as to what is major and minor.

DR. HURWITT: Dr. Costello, are nurses obliged to bring coffee or any food for the anesthesiologist in the operating room? If they do not, what do they do about his griping?

DR. COSTELLO: This is into the operating room?

DR. HURWITT: Yes!

DR. COSTELLO: Why, I would say, no! My delay is more in my amazement than in my decision. I would say emphatically "no!"

DR. HURWITT: How about you, Dr. Brown?

DR. BROWN: Very emphatically, no! In fact, maybe I'm a tyrant, but we don't have coffee at all. We feel that the schedule is very important. There's time for lunch, and we can get our coffee then.

VOICE FROM THE AUDIENCE: Dr. Hurwitt, I think that surgeons become irritable, as most men do when they become hungry. I think that considerable irritability in operating room activities is sometimes relieved by serving orange juice or milk between cases—not in the operating room, certainly, but some place nearby, perhaps the staff room or locker room—particularly for those house officers and others who are going to be spending most of their time in the operating room during the day, and that includes the nurses.

DR. HURWITT: I find that such a practice ends in more and more procrastination, and there's more and more irritation at the end of the day when the operations aren't finished.

Now, here's a question which we'll hand to all of the administrative personnel here, starting with Mr. Andrews: What policy is followed for overtime?

MR. ANDREWS: In the first place, nurses should be asked to come back or to be on call, and they should be given additional money for any time they are asked to be on call. Certainly a nurse who has to stay in the field with an operation that lasts over her certain period of time should also be given overtime, which would be approved by the administrator.

DR. HURWITT: Miss Campbell!

MISS CAMPBELL: Our policy is that all nurses, regardless of whether they work in the operating room, are paid for overtime or given the time back. I think sometimes they prefer the time. But it must be either given back or paid for within each pay period.

DR. HURWITT: Anyone else on the panel care to answer that?

MR. ANDREWS: Dr. Hurwitt, I think that it is much better to pay the employee than to allow overtime to

accumulate. If you let a nurse accumulate time and then give her a certain amount of time off, I think that practice will eventually run your schedule very far behind. I would recommend that the employee be paid.

DR. HURWITT: Here's a question for both the operating room supervisors, Mrs. Ross and Capt. Whitton: Should the circulating nurse measure blood loss in long cases, such as lung resections?

In most hospitals this is under the supervision of the anesthesiologist, but in many hospitals systems have been set up for measuring blood loss roughly, by weighing sponges.

In some hospitals this is done by a member of the house staff; in others, by a member of the anesthesia staff, and in still others, by a circulating nurse.

CAPT. WHITTON: If we notice an extreme amount of blood loss, we inform the anesthesiologist. He will come in and decide for himself. Of course, the doctor notices the loss also. The anesthesiologist usually tells the doctor that there seems to be a greater amount of blood loss than usual and asks whether he would like for the patient to receive a transfusion. Many times the blood has already been ordered and is at hand to be given to the patient.

DR. BROWN: The actual technic would have to be decided locally. I don't think anyone could make any definite rules, but as far as we are concerned the anesthesiologist is the one who is carefully observing the blood loss and the one who orders the administration of it according to the rate he feels that the hemorrhage or loss of blood is occurring. We have never consulted the surgeons about it. I don't say this in a deprecatory manner, because they've put their confidence in us, to conduct the anesthesia in the most physiologic manner possible.

DR. HURWITT: You don't actually have any technic for measuring it?

DR. BROWN: No, it is a purely clinical one. We watch the amount of blood going into the suction bottles, note the condition of the patient, check the number of large sponges and the small sponges being taken out, and note how well they are soaked. There is frequently much fluid being irrigated into patients, so that weighing under those circumstances can be a source of error.

DR. HURWITT: Miss Campbell, how can time be arranged for in-service education programs during duty hours?

MISS CAMPBELL: I think that one way to do it is to set up an in-service program with a set time when nurses are allowed to attend such meetings, if your scheduling can be arranged around it. It's difficult for all people to get there, particularly operating room personnel, but a certain percentage certainly can be allowed to go.

DR. HURWITT: Mrs. Giddens, do you have any suggestions?

MRS. GIDDENS: We send a representative from our operating group to in-service programs. A report is given to the group in the operating room by the individual who attended.

DR. HURWITT: Who is responsible for teaching medical students and interns scrubbing, gowning, and gloving technic? Do they receive any formal instruction in surgical aseptic technic? Dr. Costello!

DR. COSTELLO: Very frequently I've found that they don't—but they should. Medical students should be given very careful classroom instruction on aseptic operating room technic. They should be given demonstrations before they come to the operating room, and then they should begin under the supervision of some member of the surgical team. In many institutions it turns out to be the intern or the assistant resident.

The individual who ultimately is responsible for seeing that the standard of the technic is carried out, whether by an intern, a medical student or a staff surgeon, is the operating room supervisor. She should be given full authority to call attention to any breaches of technic.

It is not her responsibility primarily and should not be pushed off on her to see that everyone who comes in is taught the technic. Students in particular should be taught before they arrive, and should be supervised by a member of the surgical team.

DR. HURWITT: Capt. Whitton, do you treat dirty cases separately from clean cases?

CAPT. WHITTON: Yes, we certainly do, if it's at all possible. Of course it depends upon whether we're overseas or whether we're in the United States. In the United States it is easy to do. We try to separate them, either by partition or screening of some kind, and of course use the best technic that we possibly can.

DR. HURWITT: Is there anybody on this panel who does not treat dirty cases separately from clean cases? (No replies) I guess that answers the question. Mr. Andrews, please explain the co-operation given the operating room supervisor by the hospital administrator.

MR. ANDREWS: An administrator has to cooperate with every department head in the hospital, not only the operating room supervisor but every other department head. He should be behind the operating room supervisor to help her enforce staff rules. Certainly all of this will be done through cooperation with the medical staff. I think the administrator has a definite responsibility to stand behind the operating room supervisor in all of her problems in working through the director of nurses.

DR. HURWITT: Dr. Brown, here's a series of short questions: How much conversation should be carried on with the patient after he receives his preoperative hypo?

DR. BROWN: Very little.

DR. HURWITT: Should the O. R. supervisor visit the patient postoperatively?

DR. BROWN: I see no particular reason for it.

DR. HURWITT: Would you advise giving Pentothal to adults for tonsillectomy?

DR. BROWN: I personally do not.

DR. HURWITT: Should a patient's head be kept flat after spinal anesthesia?

DR. BROWN: That is a long-accepted custom. It is not really necessary, but in order to avoid confusion in nursing care we adhere to it. Actually, I was fortunate enough to do a series of several hundred cases, and found that in the postoperative period following use of spinal anesthesia it makes very little difference in what position the patient lies.

DR. HURWITT: What about the use of spinal anesthesia or Pentothal for patients who are highly allergic to medication?

DR. BROWN: That question is difficult to answer specifically, because it all depends upon the type of allergy.

DR. HURWITT: Let's say you have an asthmatic. But Pentothal would be definitely contraindicated because of its pharmacologic action.

DR. BROWN: I think it's important that that point be clarified. In some persons' minds these two agents may be classed as anesthetics, and therefore comparable, but physiologically their action is entirely different. One of the major hazards in giving Pentothal is the possibility of bronchospasm or laryngospasm. Patients have been lost from those complications when facilities for an adequate airway were not immediately at hand. One of the prime actions of spinal anesthesia, on the other hand, is as a relaxant.

DR. HURWITT: May I add that when a patient has undergone a major surgical procedure it is necessary, of course, to keep him down or perhaps in slight Trendelenberg position for a couple of hours.

Mrs. Giddens, as the degree program shortens student experience in the operating room to four weeks, where will the R.N. obtain instruction and experience to prepare her for the position of supervisor?

MRS. GIDDENS: We do not have the college program. Our students get eight weeks in the operating room. Upon graduation they can attend a college and get a B.S. or master's degree that gives them some instruction to qualify them for teaching or administration in any field of nursing.

DR. HURWITT: Miss Campbell, would you answer this question? Also, should this period of postgraduate training be financed by the school or by the hospital?

MISS CAMPBELL: In answer to the first question I think that we all must realize that even a nurse who is graduating from a four-year program with an R. N. and a B. S. is prepared only for first-level positions. I don't think that we are trying to prepare nurses for operating room supervisors right after they graduate from schools of nursing.

So far as getting her specialized training, I think that she's going to have to get it on a graduate level, along with experience. I'd like to underline experience because I think that is very important to an operating room supervisor. As for who should pay for the training, I think a person's education is something she should finance herself. Perhaps she is fortunate in being in a hospital which has scholarships or loan funds. I know that many hospitals are sending nurses away for training and are financing that training or putting the nurses on scholarships, in order that they may come

back to the hospital as better trained employees. Such programs are, I think, very helpful and certainly are improving nursing care throughout the country.

DR. HURWITT: Mrs. Ross, do you think preoperative preps should be done by the O.R. personnel, or by the floors?

MRS. ROSS: We have found at the University of Tennessee that if the student nurse does the prep on the floor, she has an excellent opportunity to see the patient prior to surgery. She enjoys this very much; she has an opportunity to teach him, to give him health guidance, to help prepare him for surgery.

DR. HURWITT: Dr. Costello, do you permit your resident surgeon to start the operation without your presence on service cases?

DR. COSTELLO: Yes, in many instances.

DR. HURWITT: So do I, depending on the case, and on the resident. And I think most of us will. "Without your presence" I think means "presence in the operating room." The attending surgeon, or the surgeon of record, in all cases must be in the hospital and must have notified the operating room to go ahead before the resident surgeon is permitted to start the case.

Capt. Whitton, providing contaminated clean-up technic is used after a sigmoidoscopy on an outpatient with poor enema results, is the procedure to be allowed in the operating room suite routinely?

CAPT. WHITTON: Say the chief of surgery has special cases that he would like to have done in surgery. We have a minor room in which these cases are taken care of. Our same contaminated procedure is used for one of these cases. Of course there's no need to wash down the walls. But the instruments definitely are soiled and are taken directly to the instrument sterilizer-washer.

DR. HURWITT: Dr. Brown, how do you care for equipment following a contaminated operation?

DR. BROWN: If you mean just an ordinary incision and drainage type of operation, there is no reason to do other than the usual cleaning of our anesthesia equipment, especially inhalation equipment.

DR. HURWITT: Do you autoclave or cold-sterilize your ampules for spinal anesthesia?

DR. BROWN: We cold-sterilize our ampules for spinal anesthesia. I know that this is now being debated very hotly among various anesthesiologists, but we have yet to have a complication, and I know that in some cases where they have autoclaved such ampules there has been some degeneration in pharmacological activity.

DR. HURWITT: Mrs. Giddens, how long are students assigned to the O.R. in your hospital?

MRS. GIDDENS: For eight weeks.

DR. HURWITT: Are they used for service at that time, or just for observation?

MRS. GIDDENS: I don't care for the words "service" or "coverage." I like to say that the students are in the operating room for learning experience.

DR. HURWITT: When do you feel the student's mind is most receptive for surgical experience?

MRS. GIDDENS: I believe students should come to the operating room in their second year in training, after they have finished their experience on the medical and surgical service.

DR. HURWITT: If a student wishes to continue in the O. R., how do you advise her?

MRS. GIDDENS: I advise her to take a postgraduate training course at a hospital that offers an advanced course in O. R. technic.

DR. HURWITT: Miss Campbell, should the surgical supervisor be under the director of nurses, or directly under the administrator?

MISS CAMPBELL: I believe that the surgical supervisor should be directly under the director of nurses.

DR. HURWITT: Mrs. Ross, what can an O. R. supervisor do about surgeons who refuse to observe operating room policies in regard to aseptic technic?

MRS. ROSS: Again, I would like to emphasize the importance of co-operation between the anesthesia department, the chief of surgery, and the O. R. supervisor. If you can, set up your policies so that there is a definite answer. For instance, we say that if anyone sees a break in technic he should say something about it and correct it.

If the surgeon will not co-operate I think the matter should be brought up before the committee. I really don't know the answer; I've had the same problem. But most of the time, if we are tactful with the surgeon and talk to him personally, he will co-operate.

DR. HURWITT: Dr. Costello, what would you suggest as basic equipment for a cardiac arrest tray—instruments, drugs, etc?

DR. COSTELLO: There are several articles that every operating room supervisor should read if she has no other access to this information. There have been several articles from Bellevue Hospital by Dr. Hugh Stevenson and others. Dr. Frank Lahey wrote on proper equipment set-up for the operating room, and, incidentally, this equipment might well be considered for other places than the operating room alone.

DR. HURWITT: More important than the exact equipment necessary on a cardiac arrest tray—as Dr. Costello has pointed out, you can get this information from a number of articles—more important than that is the point of view—that the first person to arrive at the bedside of a patient who has suffered cardiac arrest should be the person to open that patient's chest. We have not yet in our hospital had the experience of a nurse's opening a patient's chest, but if she did she would not be criticized for doing it. If the only instrument handy is a pair of bandage scissors, the chest should be opened with those scissors.

Actually, everybody who dies, dies of cardiac arrest. What we mean by the term is sudden stoppage of the heart unexpectedly in a patient who is undergoing or has recently undergone a surgical procedure. Under those conditions, opening the chest promptly and massaging the heart are mandatory. You can look for somebody else after you've opened the chest, but if you don't get the chest open there's no point in looking for anybody else.

DR. COSTELLO: Dr. Hurwitt, I would add a word of caution to what I consider your enthusiastic approach. It is still required that a physician determine when a patient is dead. Occasionally the diagnosis of death may be a problem, and certainly the differential diagnosis of cardiac arrest and peripheral vascular shock may at times pose quite a problem, particularly to nurses.

DR. HURWITT: I accept your recommendations with reservations, because I've seen many doctors err the same way. We have had the experience of having the chest opened—and we don't open them as freely as do personnel in many hospitals—and then seeing a heart that is not actually arrested but beating very feebly, and with a little massage and probably on its own equally well, will recover. I would much rather have this happen a dozen times a year than have half a dozen patients lost in genuine cardiac arrests who might possibly have been saved.

Mr. Andrews, do you think it is necessary for an O. R. supervisor to have liability insurance?

MR. ANDREWS: No, I don't. I feel that since the O. R. supervisor or nurse is an agent of the hospital, it is the responsibility of the hospital to carry such insurance. There have been many test cases in which this subject has come up. I feel that if a hospital has used good care in selecting its employees, and can prove that due care has been taken and that there was no negligence on the part of the nurse, it certainly would win the case.

DR. HURWITT: Of course what usually happens is that when something goes wrong at least three people are sued, usually four—the surgeon, the anesthetist, the operating room supervisor, and the hospital. Now it's your opinion that the hospital should assume all of this responsibility. For the surgeon too?

MR. ANDREWS: I feel that possibly the surgeon should carry his own liability insurance. Again, I think that if it can be proved there was no act of negligence on his part, he will win the case.

DR. HURWITT: Unfortunately there has been in various parts of the country an epidemic of building up cases against surgeons, many of them totally indefensible cases on the part of the complainants, but cases having an enormous nuisance value—because once a physician is brought up on charges of professional misconduct or of professional negligence, it really doesn't matter very much whether he wins the case or not—he is smeared in the eyes of the community. As a result, almost no cases ever get to trial. Any surgeon who does not carry the maximum of malpractice insurance is very ill advised, no matter what sacrifices he has to make in order to carry it. Many persons have found themselves ruined, in debt for the rest of their lives, because of having been brought up on charges which may or may not have been justified, but which have been decided in favor of the plaintiff.

Capt. Whitton, how often do you have conferences with your staff, and at what time of day?

CAPT. WHITTON: The chief of surgery has a conference with the operating room supervisors and the surgical floor supervisors once every two weeks, preferably in the afternoon when the cases have been completed.

DR. HURWITT: Would you discuss the ordinary care and cleaning of a gas machine, Dr. Brown?

DR. BROWN: Basically, the primary responsibility of a gas machine is with the one who is using it. Before one ever administers anesthesia to a patient, he should always check whether or not the valves are working and whether or not oxygen and all the other gases, particularly oxygen, are available in sufficient amounts. The primary responsibility will always devolve onto the anesthetist, but all the necessary equipment relative to that gas machine should be there also before the operation is started.

Secondarily, we have our anesthetists check each gas machine daily and replace airways and endotracheal equipment, so that any and all equipment is in perfect order for use at any time. After each patient is anesthetized, the tubes and the mask are all washed thoroughly with Septisol soap and rinsed, and then allowed to dry. As far as wiping the machine, of course, that is a matter of housecleaning.

DR. HURWITT: Mrs. Giddens, should student nurses be taken from the O. R. to attend surgical and medical ward conferences?

MRS. GIDDENS: Yes. Attendance at medical ward conferences by student nurses has value as a review period. Attendance at surgical conferences is very valuable in observing the over-all picture of patient care—the preoperative, operative, and postoperative aspects.

DR. HURWITT: Mrs. Ross, here is a question that comes up every year: How do you get the surgeon, particularly the visiting surgeon, to wear his mask above his nose?

MRS. ROSS: This always happens to an operating room supervisor! There are some operating room supervisors who have the idea that you can tell the surgeon what to do. I don't believe that. I think he should be asked in a tactful way if you may pull the mask up. So many times that method works. Try it.

DR. HURWITT: How do you handle the problem of doctors, pathologists, etc., who aren't wearing O. R. apparel who want to come in the O. R.?

MRS. ROSS: I think any person going into the operating room should wear a scrub suit. Of course he must not wear his woolen pants into the room. We get a lot of co-operation from the anesthetist on this problem.

DR. HURWITT: Here's a question which I think is very important, and I don't know to whom to address it. How does the salary of the O. R. technician compare with that of the registered nurse? Miss Campbell?

MISS CAMPBELL: I would say that the O. R. technician is probably in the same category as the prepared practical nurse, and that the usual run of the salary is two-thirds that of the registered nurse.

DR. HURWITT: Dr. Costello, in small hospitals where resident physicians are limited, is it permissible for a

graduate nurse to serve as first assistant in a major operation?

DR. COSTELLO: Definitely, yes. And there are many advantages to this practice. So far as surgical technic is concerned, some of the prettiest performances I have witnessed have been in hospitals away from medical centers, in which the same nurse assistant has worked with surgeons over a period of years. As far as the technic is concerned, there's no reason why she can't learn it as well as an individual with an M. D. She is serving as a technical assistant, pure and simple.

DR. HURWITT: I'd like to re-enforce that. Some of the best help that I had during the war years overseas on a Navy hospital ship was from registered nurses. Unfortunately, there was not enough of that. They had so many other duties to perform that frequently major surgery was done just with the help of a 17-or 18-year-old boy who'd had a few months of O. R. experience.

Capt. Whitton, what can be done to keep powder from flying all over the rooms when powder packs are being used? The gloves and powder are put on in the area of sterile instruments.

CAPT. WHITTON: We usually are away from the instruments when we put on our gloves. When we aid the physician, we also keep the powder away from our instruments. Physicians are gowned and gloved separately, in the same room, of course, but not right on top of the instrument table. A damp towel is placed over a pail in one corner of the room. The doctor then powders his hands over the pail. This helps prevent the powder from flying around the room.

DR. HURWITT: Mr. Andrews, here's a touchy question for you: If much of your elective surgery is unnecessary in a hospital with no medical audit, what can be done? We are not referring to illegal procedures, but to removal of normal tissue—normal appendices, normal uteruses, normal gall bladders. This is a very serious practice throughout the entire country.

MR. ANDREWS: I think this matter would be taken up through the staff. Certainly most hospitals of today have a tissue committee, which would report on this type of thing, and of course if it found a man was doing unnecessary surgery certainly the matter would be taken to the executive committee or the medical staff, and action would be taken by that group.

DR. HURWITT: Unfortunately, in many hospitals where this is done the executive committee is impotent, or contains the men involved.

What about the wearing of operating room dress, with masks hanging loose, when not on emergency errands? Why do personnel wear them in the dining room? They are soiled and grimy. How can this practice be stopped?

MR. ANDREWS: I think it's just a matter of using a little tact, and I don't think that there's any definite rule that you can follow. Sometimes it is necessary for a doctor to leave an operation and go to the dining

room in his scrub suit, because he may have an appointment or another operation to go to.

DR. HURWITT: Dr. Brown, what do you consider a satisfactory arrangement between the M.D. anesthetist and the hospital? When should the M. D. anesthetist charge the patient for the administration of the anesthetic agent? If the M. D. anesthetist gives several spinals in succession and the R. N.'s employed by the hospital sit with the patient, should the hospital be reimbursed? If so, at what rate?

DR. BROWN: There have been several surveys on this subject, and there are as many opinions as there are surveys. So it's impossible for me to give you any definite answer. It depends to a certain extent on the locality in which you're working, and what the arrangement is in that locality.

DR. HURWITT: It's a matter of economics that varies tremendously in different parts of the country too, depending on the policies of the county medical society and the difficulties that the local anesthetists are having with the supreme board of anesthesiology.

Mrs. Ross, how much time do you allow between cases?

MRS. ROSS: In our hospital we set up each operation individually, for from 20 to 30 minutes.

DR. HURWITT: Should the O. R. nurse on call be compensated for on-call time, regardless of whether she works or not?

MRS. ROSS: That's up to the individual hospital. In our hospital no one takes call, because a nurse is on duty at all times. If she is on call at home or takes call from a room provided in the hospital, perhaps her overall salary can cover this inconvenience, and she will not have to be paid for each individual call.

MISS CAMPBELL: I think the question is debatable; however, we do not pay nurses unless they actually work. I think there is a feeling that when the operating room nurse is on call she has to stay at a certain place. We do not insist that the operating room nurses stay in the nurses' residence or in the hospital. They come in from their own homes.

DR. HURWITT: Mr. Andrews, are you willing to take sides?

MR. ANDREWS: I certainly am. If you have a person on call, whether she be at home or elsewhere, she is still at your convenience and the convenience of the hospital. I don't see how you can ask a person to stay at home and be on call without giving her some type of reimbursement. That's my own personal view.

Patient-Centered Care

By Edythe L. Alexander, R.N.*

● Optimum care for patients requires the vision, vigilance, and research of all persons who are concerned with or participate in its production, but essentially it depends upon the leadership provided.

Today, many operating room nurses try to supervise solely by retaining personal and individual relationships with their surgeons, nurses, and workers. This is no longer possible within our modern operating rooms. Group action has succeeded individual action. Now the supervisor-staff member relationship is increasingly that of group to group. Building upon this approach, the employee and employer may lose some values, but the advantages gained by the groups and the patients offset the losses.

To improve nursing service, the graduate nurses must be given freedom in which to work and develop paths of communication so that they can extend their ideas to those who are carrying out nursing duties. In itself, this is not easy; but the path to patient-centered care becomes less arduous if we accept the group approach, and if we use good management and teaching skills. In the operating room, the graduate nurses must develop better working plans and utilize all opportunities to evaluate new and old procedures, and help their co-workers to observe and evaluate the patient's needs as a basis for giving care.

We would all agree that the persons who enter our operating rooms as patients are very important people. We would agree that the people who care for patients are important. At least we give lip-service to this philosophy. We know that good nursing care is given when all personnel carry out their prescribed tasks correctly, completely, and safely. We also know that optimum care requires expert assistance from the personnel in other departments in the hospital—the bacteriologist, the pathologist, the engineer, the nursing teams stationed in the units, the supply room, and the recovery room, as well as the educational leaders, the medical staff, and the administrators.

Our modern operating rooms comprise a network of interrelated and interdependent parts within the hospital. Sometimes the interrelationships and interde-

(This paper and the one on page 160 were presented at a panel discussion on "Staffing the Operating Room in Relation to the Future," at the 1955 A.O.R.N. Convention in St. Louis.)

*Miss Alexander is assistant editor, American Journal of Nursing, New York City.

pendence are not recognized until we try to make changes, such as installing new equipment, revising a procedure, or employing a new group of workers. In order that the best care may be given to all patients, there must be a real relationship between the patient and those who are giving the care, between the supervisor and those who are being supervised, and between the supervisory group and persons in other departments.

In some situations the patient is accepted only as a body whose complex anatomical structure and function is diseased or injured. Yet we know that the sick person places a great value on our services, and we also know that his attitude may be quite different when he is well. To the patient, the physician and the nurse stand for security, the relief of suffering, and the hope of recovery. Do we underestimate the value of this association? We also should remember that a person looks upon his body as a mystery of complex design and function which is understood by the physician and nurse. Today, we are aware of the delicate interplay between the mind and body, and realize that many diseases that are surgically treated have components of both a psychological and physical nature.

CONSIDER PERSONAL MOTIVATION

When we help our personnel, do we take into account personal motivation, family background, and existing social pressures? Do we develop a group approach in caring for our patients? If we agree that both the patient and personnel are important, we see our tasks revolving within a system of human relations.

Discussing O.R. staffing at the A.O.R.N. Conference in St. Louis were (l. to r.): Sr. Mary Suzanne, dean, St. Louis University School of Nursing; Mabel Northcross, ORS, Homer G. Phillips Hospital, St. Louis; Sr. Olivia D. Drusch, R.N., director of nursing education and nursing service, Evangelical Deaconess Hospital, St. Louis; Ethel West, R.N., Methodist Hospital of Southern California, Los Angeles; Edythe L. Alexander, assistant editor, American Journal of Nursing. Miss Alexander's paper appears above; Mrs. West's is on page 160.

The gowned, masked personnel who hurry down the halls as they pass the worried patients, the many instruments lined row upon row on the numerous draped tables, the odor of disinfectants, the searching lamps, the buzzing saw, the placing of a patient on the operating table as if he were a contortionist—all are necessary in our operating room, but they push away the personal, gentle touch in caring for patients. How the personnel accept their duties and work together influence and often determine how the patients accept their problems.

In good impressions, the patient sees his operating room experience, through the members of the nursing team, as a place where kindly, considerate, and thoughtful people are concerned about his welfare. Do we allay anxiety regarding the anesthetic, the insertion of an endoscopic tube, the insertion of a Kirschner wire, and many other procedures to which our patients are subjected? Do we stop to wonder how a patient feels about them?

If we employ sympathy and gentleness, we can realize and appreciate more deeply the patient's feelings and difficulties. The act of surgery requires gentleness, yet gentleness is too often taken for granted. Too often we assume that it will be applied by each person who helps care for the patient. The practice of gentleness can be a conscious habit. The team member uses her voice and her hands with gentleness consciously, because she knows it is good nursing. When the nurse or attendant places the patient on the operating table, she uses thoughtful, objective gentleness, based not upon sympahy alone but upon knowledge that the malignant tumor of the lung is an incessant source of human fear, and that proper positioning may help control the cancer cells. Habitual gentleness develops from the worker's understanding of the disease, the medical standards, and technics, as well as from experience and the ability to identify herself with the human race.

NEED FOR GRANTING AUTHORITY

To provide good relations between the patients and the people who are caring for them, our organization chart must give all workers the authority to work together with the patient. Our traditional charts depicted a series of closed boxes rather than a series of concentric spheres. Ideally, this sharing and communicating extends out in all directions, to and from the patient. Horizontal or technical specialization has been applied in industries, because it has made possible the vast increase in mechanization. Mechanization in the operating room can in turn reduce the patient's costs for care, and it can contribute to better nursing care.

If functional authority is planned around the patient, the first group surrounding him includes the staff nurse, the technicians, the attendants, and the nursing aides, as they have the closest contact with the patients. The professional graduate nurse in this group is aware of the patient's total needs and is responsible for seeing that they are fulfilled. She prepares, administers, and supervises the care of patients who are assigned to her rooms. She knows the scientific basis for and applies aseptic principles in carrying out procedures. She helps teach the nonprofessional personnel the technical skills

of their job; she interprets to them the patients' needs.

The general staff nurse also participates in the administration of the service. To give good care the professional nurse can no longer be content to carry out repetitive tasks that are required in some procedures, and to carry out orders given to her only by the supervisor or surgeon; she also must be ready to interpret to others what she sees, to evaluate the needs of the service, to observe and evaluate the worker's performance, and relate these facts to her leaders.

As a professional nurse-practitioner she works with other human beings as a contributor to the improvement of the service. In our preoccupation with management technics, the tremendous advances in surgery, and the scientific discoveries which have been adapted to surgery, we must keep before us the purpose for which they exist—to give care to patients. So let us be certain the special skills of the professional nurse are therapeutic as well as highly technical.

The chart's second circle is wider, since the head nurse's functions include a wider range of activities. The head nurse has closer contact with the nursing teams and the supervisor than with the patient, but her efforts are directed in helping the personnel provide good nursing care to all patients. She has become an essential person in the operating room because of the advances in surgery, the use of modern technical equipment, and the increase in the number of nonprofessional workers. All her activities are directed toward the patient as she works with the nursing teams, the surgeons, and the supervisor. She is responsible for providing a high quality of care, for conserving costs, for providing proper opportunities for the staff's growth, and for creating an atmosphere for good nursing and personnel job satisfaction.

In making the daily assignment with the graduate nurses according to the plans agreed upon by the supervisor and staff, the head nurse considers the patient's needs, the approximate time necessary to carry out the tasks, and each team member's ability to perform these tasks.

MAY GIVE DIRECT CARE

There are times when the head nurse gives direct care to patients; that is, she may "suture" or "circulate" as she teaches a staff member, or she may help out in an emergency situation, or give care for personal growth.

The third circle of our chart is again widened, since the supervisor's activities include guiding and directing all nursing personnel in the department. The supervisor accomplishes her tasks by directing the efforts of the staff through planning, directing, controlling, and co-ordinating the service, so that the care of the patients will be done correctly, safely, and completely. The supervisor acts as an administrative multiplier by guiding and inspiring many people to carry out those duties that she knows will benefit the patients. But this job is not a desk job for the entire day. She must see the service that is given to judge correctly and to identify the weaknesses and strengths in the staff's performance. She evaluates nursing service so that she can establish goals and find ways to achieve them.

The supervisor believes that learning results in changing a person's behavior, and that it is more likely to occur if the worker knows and accepts the reasons for learning a task. She also realizes that she must determine how far the personnel have gone in reaching perfection in their tasks.

Although the supervisor has close contact with the head nurse and graduate nurses, her functional authority is surrounded by a larger circle—those of the administrative and hospital service groups. From a horizontal view, she shares with other hospital groups in providing services. She is the interpreter of the needs of her service to the nursing service administrator, and of hospital policies and aims of nursing service.

There are several essential factors that must be accepted if the functions of the operating room nurses are to be clearly defined so that effective nursing care will be given. First, we must examine the objectives and aims of each position in the department. This is accomplished by a group approach to nursing service, so that better working plans can be developed. We must consider how to create a good atmosphere in our department for the patients and workers. In caring for the patient we must use objective gentleness and recognize his problems.

We must use functional authority as a means of defining the professional nurses' functions and their relationships with other workers in the department.

Perhaps the most meaningful advance that we can make toward patient-centered care occurs when we ourselves actually put into practice our belief that the patient and the people who give this care are important people. Your gentleness, your positive attitude towards patients and personnel, your counseling skills, your understanding of the feeling involved and the causes behind your own performance, your acceptance of help and advice from others, your ability to interpret principles of administration and management, your desire to study and evaluate methods, your faith in yourself and others—these things will help you as leaders of your co-workers who help care for the patients.

Results of Anesthesia Survey Reported

● Only 52 percent of the anesthesias dispensed in hospital operating rooms are administered by qualified persons, according to results of a questionnaire sent by the American Association of Nurse Anesthetists to 7,032 hospital administrators in the nation.

Results were reported at the 22nd annual meeting of the association in Atlantic City.

Of these anesthesias, 34 percent are given by members of the AANA and 18 percent are given by members of the American Society of Anesthesiologists.

Of the remaining 48 percent, 27 percent are given by physicians whose qualifications as specialists are unknown, 19 percent by nurses whose qualifications are unknown, and two percent by persons who are neither registered nurses nor physicians.

The greatest lack of qualified anesthetists was found to exist in small hospitals where such personnel are difficult to obtain because of the present shortage.

Commenting on the extensiveness of the need for trained anesthetists brought to light by the questionnaire, Mrs. Jessie Compton, chairman of the AANA committee which conducted the survey, said, "Since almost 18,000 persons would be required to give 100 percent coverage of anesthesia service by trained personnel, all persons involved in this problem should co-operate to provide more well-trained nurses, as well as physicians, in this field."

Some state presidents gathered after a social affair at the national convention of the American Association of Nurse Anesthetists. Standing (l. to r.): Pauline Benefiel, Methodist Hospital, Indianapolis; Helen Mahoney, Denver, Colo.; Josephine Boyle, Johns Hopkins, Baltimore, Md.; Ida Cameron Workman, Mercy Hospital, Charlotte, N.C.; and Matilda A. Welinske. Front row (l. to r.): Minnie Haas, St. Joseph's Hospital, Ft. Worth, Tex., re-elected national president, and Marjorie Hunter, Cincinnati (O.) General.

The Role of the Surgical Technician

By Ethel I. West, R.N.*

● You may not like it, but surgical technicians are here to stay. So why not accept them graciously? Instead of being mentally antagonistic toward them, why not use their assistance to advantage?

If you analyze the situation, you will find them necessary. We must recognize that hospitals are faced with a serious problem. The number of patients entering our hospitals has increased, while the number of professional nurses staffing the opertaing rooms is inadequate. As a profession we are dedicated to the relief of human suffering. The public looks to us for help. We cannot refuse.

A solution has to be found to relieve the increasing pressure. The logical solution to this problem of inadequate supply of professional nurses is to supplement them by training nonprofessionals for more valuable assistance in the operating room.

*Mrs. West is operating room supervisor, Methodist Hospital of Southern California, Los Angeles.

Years ago, all the housekeeping was done by professional nurses, but now we realize it is a waste of talent and education which should be utilized to better advantage, leaving the housekeeping duties to auxiliary personnel. We have become accustomed to having a great deal of the repetitive tasks done by an auxiliary group. We welcome new procedures and new equipment, but it is quite another matter when they affect personal feelings and attitudes. There must be more flexibility in our thinking. The modern concept of administration is to encourage workers to develop competence in their profession. Technical competence is important, but the ability to understand and lead a group is an outstanding quality. We all know that teamwork is essential in the operating room.

What is teamwork? It is a concerted effort by a group of people working together. They must have a common purpose or plan. The plan must be well organized, completely understood, and accepted by all team members.

Our whole routine in the operating room revolves around a team. Why not make the surgical technician a member? Let us briefly review some of the duties of this team. Much is expected of the operating room supervisor. Her duties seem endless. Among her many attributes must be leadership. Every leader realizes the importance and value of everyone on the team contributing her best toward making the team plan workable and effective. The operating room supervisor, in order to give maximum service to the patient, must appraise the value of each member of the team and direct her individual talents and ability to obtain her best contribution. Any variation from usual procedures, whether it concerns procedures or equipment, should be explained.

Another important member of the team is the professional staff nurse. She must be taught to develop leadership and teaching ability. Teaching is a skill that can be learned, and in the learning the staff nurses themselves will acquire greater skills and increase their own knowledge. By their own attitude they will inspire confidence, poise, respect, and admiration. In a teaching program the standards of the hospital are benefited. Also, this program will prepare auxiliary personnel to perform certain functions with safety and understanding.

WILL NOT REPLACE R.N.

I do not believe that surgical technicians will ever replace the professional nurse, but they can fill a present-day need for operating room personnel. Before a surgical technicians' program is started, the hospital's standards and policies must be determined. The need for surgical technicians and their functions should be interpreted to the medical staff. Both doctors and surgery personnel may be saved future embarrassment if all are familiar with the duties of the technicians.

Careful selection must be made of the candidates applying for these positions to determine their qualifications. Technicians are not professional people. They have not taken the training and studies required for graduation for professional nurses; so their duties and responsibilities are limited. Their reactions vary. Their potentialities and capabilities must be determined to see where they are best fitted. Some have manual dexterity and make good suture nurses. Others may be slow to adjust and may require more guidance, but by constant application can be developed. They must constantly work under supervision and must be developed to meet the needs of the hospital.

A program of instruction should include formal teaching, demonstrations, discussions, and problem conferences. To be effective, the level should not be placed too high. It should be simple, concise, and well planned, but adapted to meet the requirements necessary to give effective instruction. Situations vary with each hospital, and no set pattern can be used routinely.

Each individual should be made to realize that she is an important member of a team whose sole purpose is to expedite the recovery of the patient. To be effective as a team, team members must not only know their own duties, but understand the functions of the rest of the group.

An in-service training program should be started during the technicians' orientation to the operating room unit and to the hospital. Ethics should be stressed so that they know how to conduct themselves, not only in surgery, but elsewhere in the hospital.

Daily assignments should be given and procedure books and cards used to demonstrate standardized technics.

How soon a technician is able to function without direct supervision depends on the skill and ability of the individual, but she should always be responsible to the professional nurse.

Conferences at stated intervals, including all members of the team, are important. Questions should be encouraged and suggestions given consideration. The participants should provide the material for demonstrations and discussions, as far as possible.

In a technicians' teaching program, orientation should include introduction to supervisors and personnel and a tour of the operating room suite and hospital, with conferences covering:

1. Aims of program, operating room and hospital ethics and policies, with relationship to other personnel
2. Line of authority in the hospital and O.R.
3. Responsibility to patient
4. Legal responsibility
5. Safety in the O.R., including precautions necessary against fire and explosion hazards
6. Care in the prevention of industrial accidents.

SUBJECTS TO COVER

Some of the subjects for discussion and active demonstration are:

1. Short basic course in anatomy
2. Classifications of operations
3. Nomenclature
4. History of surgery
5. Principles of asepsis
6. Sterilization—history, methods, and principles
7. Sutures—history, types, uses, and sterilization
8. Needles and knife blades—varieties, use, and sterilization
9. Assembling of packs
10. Opening and handling sterile supplies
11. Autoclaves—mechanism and operation
12. Tables, lights, cauteries, and other electrical appliances—care and function
13. Syringes—care and sterilization
14. Hand scrub
15. Gloves—care and sterilization
16. Gowning and glove technic
17. Instruments—care, sterilization, and assembling of basic sets, special sets
18. Draping of patients
19. Positioning of patients
20. Contaminated technic
21. Drugs and solutions

22. Anesthetic equipment—including assembling, cleaning, sterilizing of IV sets, spinal sets, caudal, and local

23. Preparation of patient's skin

24. Casts and responsibilities of orthopedic equipment

25. Cystoscopies—preparation, care of equipment

26. Assistance in transferring patients from ward to O.R. and back to recovery unit or ward

27. Care of specimens

28. Care of other equipment and facilities which is not the responsibility of the housekeeping department.

After completing the course of formal classes, technicians can be taught to scrub as second scrub nurse on major cases, and as solo scrub nurse on minor cases, and become capable of circulating on most types of operations.

How successfully the surgical technician works depends on the acceptance of the program by the professional nurses. Capable, intelligent supervision, given by professional personnel willing to teach and lead, will help to establish a well-organized, efficient department. Skill is important, but the professional personnel must be sympathetic to produce results.

The program is a challenge to the professional nurse to continue her own educational program and to keep up with new developments and procedures. It appeals to the individual's desire to develop a feeling of personal worth. The technicians' value to the department will increase to a greater extent if the technicians know they are wanted and accepted.

The professional nurse must realize that the surgical technician will never replace her, but will rather strengthen her position in the O.R. If you are in an operating room in which surgical technicians are already employed, or one in which the hospital contemplates using them on the O.R. staff, take advantage of the situation. Upgrade yourself by becoming efficient as a leader or teacher.

We must face realities and solve our mutual problems wisely and with a feeling of great responsibility to our patients.

Below: The 1954 O.R. Yearbook from HOSPITAL TOPICS, off the press just in time for the A.O.R.N. Conference, was featured at TOPICS' exhibit, where also available were numerous reprints of TOPICS' articles on common O.R. problems.

Preoperative Skin Preparation*

Carl W. Walter, M.D.**

Dr. Walter

● Disinfection of the skin is a perennial problem in most hospitals. It assumes monumental proportions largely because we fail to recognize the actual problem which is to destroy pathogenic bacteria which are facultative for humans. Facultative organisms are ones which have grown and caused disease in humans, and hence establish themselves very easily on other humans.

The bacteria which are found in the kitchen at home, in the ordinary workshop, and other familiar surroundings, are not dangerous to health except under rare circumstances when they are implanted with a foreign body to enable them to get a start. Ordinary skin bacteria are not dangerous.

There are occupations in which humans encounter dangerous organisms frequently. These are well known and described in the surgical literature as definite industrial hazards. The skin lesions from fish-cutters, in which bacteria from fish are implanted into the skin, and the abattoir lesion, found on the hands of people who handle cattle, are examples of occupational lesions in which facultative organisms are implanted on human skin. An organism which was very widely spread in machine shops is the ordinary *Staphylococcus albus*, which grows in cutting oil, used to cool the tools on lathes, drills and presses. When it becomes embedded with bits of metal in workers' hands, it causes a great deal of difficulty.

In the specific hospital, these various areas present no great problem. The problem is to take care of a kind of skin which is more dangerous than any which I have discussed, because that skin contacts human disease daily, picks up pathogenic organisms which are actively producing disease in humans, and carries those organisms from one patient to another. These bacteria are becoming increasingly important in the daily care

*Address presented at Second National Conference, Association of Operating Room Nurses, St. Louis, January 24-27, 1955.

**Associated Clinical Professor of Surgery, Harvard Medical School; Surgeon, Peter Bent Brigham Hospital.

of patients because they survive the onslaught of all our chemotherapeutic and antibiotic agents. They are resistant to modern miracle drugs, and when they are implanted in a wound we have an epidemic which represents somewhat the epidemics described by Lister in the days before antisepsis. Because hospitals are becoming infested with this type of antibiotic and chemotherapeutic-resistant organisms, we have an ever-increasing problem in controlling sepsis in the operating room.

A recent report by Howe from the Massachusetts Memorial Hospital[1] showed an increasing incidence of postoperative sepsis at an annual increment of 1.2 percent, every one of the causative organisms being antibiotic-resistant, every one being *Pseudomonas* or *Staphylococcus albus*. Landy et al, of the University of Chicago, at the American College of Surgeons' congress last October described an aureomycin-resistant *Staphylococcus albus* in the nose and throat of a surgeon, undergoing treatment with aureomycin.

Once you recognize that this is the kind of organism you should think about when you discuss disinfection of the skin, it becomes obvious that it is not the disinfection of the patient's skin, it is the disinfection of the doctor's skin, the nurse's skin, the orderly's skin that is important. The patient who has been hospitalized for many weeks or months presents a similar problem. The one who comes from home on Thursday afternoon to be operated on Friday morning does not have an overwhelming bacteriologic problem. The chances are that you can operate on him following simple washing of the skin and have no difficulty whatsoever.

With this orientation on the kind of bacteriology we're discussing, I would like to describe the various problems in skin disinfection with which we must be familiar.

There is an anatomic problem because skin is a complicated structure. There are plain gross differences in skin, the thick squamous epithelium of the sole of the foot, the palm of the hand, the dorsum of the back, or the very thin epithelium of the abdomen, the protected epithelium of the axillary fold, the inframammary fold, the groin, the scrotum—each of these areas has an anatomic structure which differs. It is exposed to a certain amount of friction, or it is protected from friction, and hence the bacteria which we find differ not only in numbers but in kind. It is very difficult to find bacteria in the skin over the olecranon process because we rub off the desquamating epithelium, and with it go all of the bacteria.

On the other hand, in the inguinal region or the perineum, the axilla, the inframammary fold, where desquamating epithelium does not get rubbed off by clothing and other types of friction, you can generally find many more organisms, because they grow in the accumulated layers of desquamating epithelium.

Skin grows from ordinary cuboidal cells which, as they mature, are pushed toward the surface. As they move away from the vasal layers, the vital protoplasm tends to concentrate and dry up. Gradually the nuclei disappear, and what was a cuboidal cell finally becomes

[1] Howe, Chester W., "Postoperative Wound Infections Due to *Staphylococcus Aureus*," New England Journal of Medicine, Vol. 251, No. 11, September 9, 1954.

a very flat squamous cell, and the protoplasm keratinizes or cornifies and it becomes typical skin.

If you scrub off the desquamating epithelium, you get down to the layer where blisters form. If you puncture a blister, you find the raw, bleeding, fresh weeping base, which represents the living cells that produce the epidermis. Everything superficial to that is in the process of dying and being desquamated.

It is in the desquamating cells where most of the bacteria we discuss exist, and hence they can be rubbed or scrubbed or blistered off, if you like. This is mechanical removal of these organisms. During the ordinary course of events, bacteria grow down into the newly formed layers of cells at about the same rate that the newly formed cells are growing toward the periphery and are casting off the dry cornified epithelium. In protected areas like the scalp, we are used to seeing this. The flakes of desquamated epithelium are called "dandruff." You can culture the organisms that are growing in the scalp in these flakes of epithelium.

This normal process of growth occurs not only on the surface of the skin but also in the ducts of the skin glands and in the hair follicles. Each anatomic area of the skin has its characteristic representation of glands of one kind or another. The bacteria are busily growing into the ducts through the secretion and the desquamating duct cells at about the same rate that new cells in the duct are pushing out and sweeping the bacteria toward the surface. The skin, therefore, disinfects itself by this mechanical purge toward the surface.

This steady state is maintained fairly well except when trauma drives the bacteria deep to the surface cells, or when we have overwhelming disease like a respiratory infection, in which the ordinary immunologic processes are overcome and the skin finds itself defenseless in keeping bacteria under control. Then the normal flora, plus those which we put on the skin by handling handkerchiefs or sneezing, grow wildly. In a person with respiratory disease, the same secondary invaders which characterize the bacteriology of the nasopharynx can be identified in overwhelming numbers in the desquamating epithelium of the hands or any exposed skin of the body. These bacteria are dangerous because they are causing disease in a person (the host), and anything that he touches can implant these organisms into wounds, to other people, and hence convey disease.

Figure I shows a schematic section of skin. The area between the first pair of the lines at the right (e) represents the desquamating epithelium. You see that it has a very complicated surface with many nooks and crannies, and many hills and valleys. It is quite natural to suppose that on the tips of the hills the bacteria gets rubbed off, and in the valleys they tend to build up. The broader band deep to the epidermis is the corium (f), where you have the prickle cells and the skin is busy replacing itself.

Here are a number of skin structures. The big long telephone poles represent hairs (a); a sebaceous gland (b) furnishes the sebum to keep hair flexible and greasy; (c) is a sudoriferous gland, which gives char-

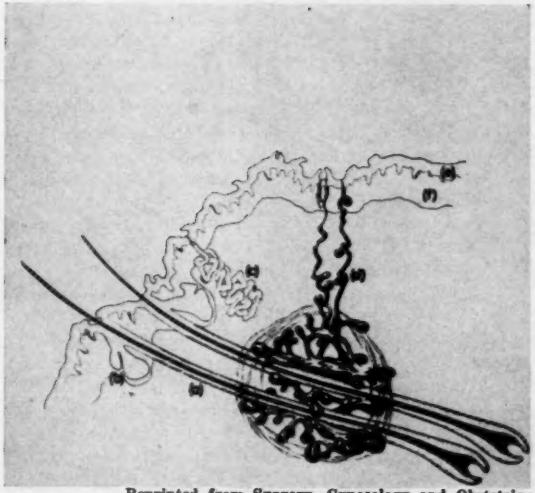
acteristic odor and helps us to perspire; (d) is a more complicated gland.

Bacteria grow in these glands, as is shown in Figure II. This is a section of skin which has been incubated so that the individual organisms could grow out to form clumps big enough to show when stained. Here you see a sebaceous gland and its typical acini. Here its duct begins and goes out toward the surface of the skin, and you see the masses of bacteria growing in the duct. Notice that they are more plentiful toward the periphery than deep in the gland.

At the top, that black material which looks like a shingle roof is desquamating epithelium. At half past one you can see the individual cell outlines of the keratinizing cells. The black layers are masses of bacteria growing in the desquamating epithelial cells.

The surface cells and bacteria can be rubbed or scrubbed off very easily. They reflect the daily contacts and soil on the skin. These bacteria are termed the "transient organisms."

The organisms which grow deeper into the epithelial cells and in the ducts are the normal saprophytic inhabitants of the skin. They represent the residents, and they are impossible to scrub off. When you put a pair of rubber gloves on over disinfected skin and then begin to perspire, these organisms are purged from the glands and load the sweat inside a sterile rubber glove with many organisms. It's just like injecting the glove with millions of gland loads of organisms. This is one way in which the resident organisms get out of the skin.



Reprinted from **Surgery, Gynecology and Obstetrics**

Figure I

Schematic presentation of an apocrine gland as constructed from the composite outline of 110 serial microscopic sections cut at approximately 7 micron intervals: (a) hair follicle; (b) sebaceous gland (holocrine); (c) sudoriparous gland (eccrine); (d) apocrine gland; (e) epidermis; (f) dermis. Apocrine gland X 11. Sudoriparous gland X 11 (after Huber). Sebaceous gland X 11.

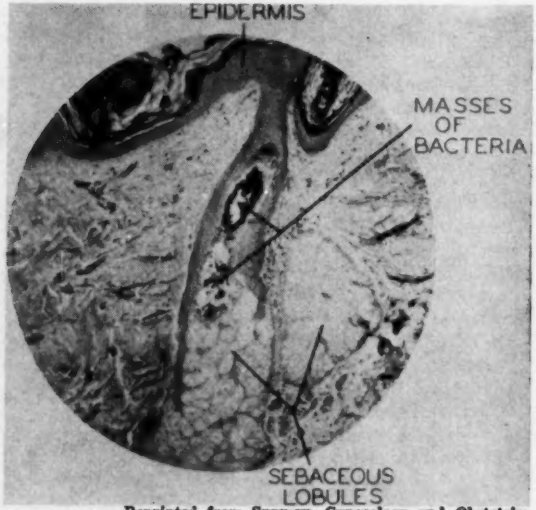


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Figure II

Photomicrograph showing a section of skin removed from the female breast and incubated for six hours. The surface of the skin was cleaned with iodine and alcohol before removal, and the section was stained to show the bacteria. Large masses of bacteria are shown extending deep into the sebaceous gland and far below the skin surface.

If a facultative organism is implanted while caring for an abscess, scarlet fever, a respiratory disease, or hospital sepsis, it first contaminates the surface, but every once in a while it grows down and becomes established deeper in the skin, and then we have a person who is a carrier for this kind of organism. This carrier state is very difficult to control, and very difficult to eliminate. Philip Price (Figure III) showed, in China, that it took him months to get rid of streptococci from his hands which he had acquired while caring for wounded Japanese soldiers.

This is how the doctor and the nurse play a role in carrying disease from one patient to the next.

You can see that it is important to eliminate layers of desquamating epithelium periodically from the surface of the skin. Otherwise all the valleys fill up with good culture media and masses of organisms. The peaks or the mountains are always clean because friction rubs them clean. This is why you need to brush your skin every day in order to clean out the nooks and crannies, and this is why, in ordinary hospital practice, just washing with a cloth or sponge is ineffective in the control of skin bacteria.

Daily scrubbing does not have to be prolonged because you can remove bacteria mechanically very easily. Figure III, from one of Price's original studies, shows the rate of removal of skin bacteria by simple scrubbing with a nylon brush and distilled water. As you scrub, the number of organisms removed becomes less and less,

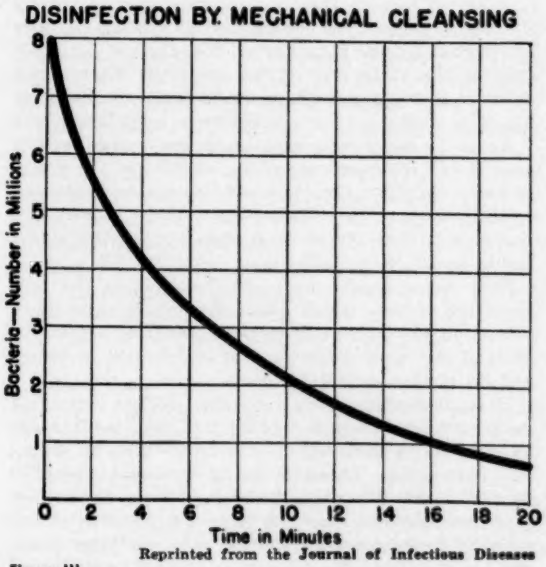


Figure III

until after about 20 minutes the curve becomes asymptotic, and you can scrub practically indefinitely and remove the same number of organisms per minute.

What you are doing is massaging organisms out of the glands at about the same rate they are reproducing. When you start with a skin which has not been scrubbed for a couple of weeks, you have the problem at the left of the chart. You scrub bacteria off quite effectively in 10 minutes.

Once the base line is reached, the data on Figure IV pertain. It takes 10 days for the skin flora to re-establish themselves. If you scrub every day, accumulation of desquamating epithelium is prevented. Such a skin can be kept safe by scrubbing with nine strokes of a nylon bristle brush every day, with 15 strokes to the subungual spaces and paronychial folds. This presumes no additional trauma like changing a tire, digging in the garden, patting the dog, and all the things we are wont to do.

If you scrub only every five days or so, you have an entirely different problem, because the bacteria have an opportunity to re-establish themselves, and you have to remove them by more prolonged scrubbing. Experience has shown that it requires about 15 nylon bristle brush strokes, and 25 to the nails, to remove the accumulated cells and bacteria.

If you are an occasional operator (every two weeks or so), you come in with a maximum load of bacteria. You have a maximum problem that requires 30 strokes

of a good nylon bristle brush and some 50 strokes to the subungual and paronychial spaces.

This is why everyone who approaches a scrub sink has an individual problem that he must define for himself. He must remember how often he has scrubbed; he must take cognizance of trauma which has embedded dirt in his skin and under his nails. This is why the obstetrician who works every day has no problem at all. This is why the surgeon who works every day has gotten away with just a lick and a promise, and we all look askance at him. If the occasional operator used the same technic, he would be in difficulty.

The nurse who is taking care of infants in a premature nursery, scrubbing once a day, washing her hands after every contact, really has no great problem. I would like you to bear in mind this definition of the kind of bacteriologic problem which we have at various times and why it differs between individuals, and in each individual's daily experience in the course of a month or a year.

It takes daily scrubbing to keep the desquamating epithelium down and to keep the skin in normal control. What application has this? I think that you can well understand the mechanical side. We have to get a smooth skin; we have to get everything off which we can mechanically.

From the chemical side there are several approaches which can be used. The classic approach has been to use very strong disinfectants to destroy the bacteria on the skin by a single application. Seventy percent ethyl alcohol, 50 percent isopropyl alcohol, two percent aqueous iodine, and any of the quaternary ammonium compounds, represent materials which are single-shot germicides. They destroy all the surface bacteria they contact, but because they precipitate a layer of protein as they penetrate the desquamating epithelium, they automatically form a barrier, so that they do not penetrate to the areas deep in the epidermis where fresh cells are growing and where the bacteria are multiplying. The single-shot germicide exerts a surface effect.

About 15 years ago, experience was gained with a penetrating detergent germicide which has the power of penetrating into the ducts and into the desquamating epithelium along the viable fringe. When it goes into this area it prevents bacteria from multiplying at the viable border of the epithelium.

This bacteriostasis is so effective that as the cells grow, the bacteria which cannot multiply to grow down into them are purged from the skin. This forms the basis of our modern technics for disinfection of hands, and for certain patient problems.

Hexachlorophene is one of the efficient detergent germicides which can be used for this purpose. It works by suppressing bacterial growth rather than by single-shot destruction. To use it ideally, it should be applied every day; the skin should be brushed every day to keep it in good physical shape. A technic must be developed whereby hexachlorophene, either in a synthetic detergent or in a conventional soap, is applied properly and conscientiously to keep the bacteria suppressed.

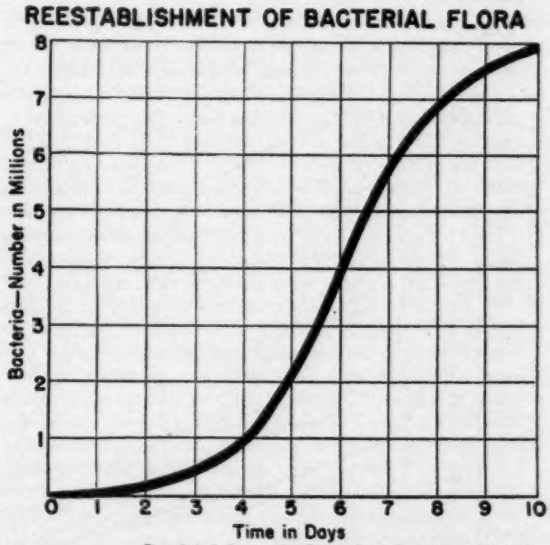
This does not mean that you cannot use any of the classic single-shot germicides in addition to hexachloro-

phene. It is perfectly logical and feasible, because there is always residual dirt under the nails, where a powerful single-shot germicide can be expected to penetrate and where we cannot wait for suppression.

A combination of daily suppression plus a single-shot application to destroy the transient organisms in traumatized skin or the dirt under the nails not controlled by biologic suppression is good technic.

Hand care for the surgeon, obstetrician, operating room or delivery room nurse reduces itself to the problem of brushing the hands with nine strokes of a nylon bristle brush every day, using a detergent or soap containing hexachlorophene detergent, or soap. This should be done faithfully. It does no harm to use ordinary soap occasionally. The hexachlorophene is leached out, but the next time you wash with hexachlorophene you put it back in again. There is no "all or none" rule to this —it's just a question of what the majority of the exposure is.

This is a good technic for nurses throughout the hospital—for instance, those in communicable disease units and in the nursery. The big thing to remember is to use it after every patient contact rather than before, because in this way you wash off, mechanically, the facultative organisms, the dangerous hospital bacteria which you pick up while you care for patients. Your hands are then safe. The bacteria do not have a chance to grow and become saprophytes on your skin, to which you may have no disease response but which may cause trouble in patients.

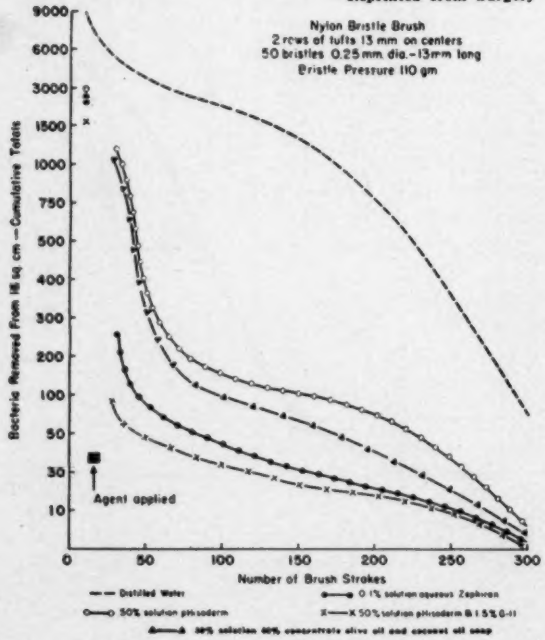


Reprinted from the Journal of Infectious Diseases

Figure IV

Figure V

The comparative disinfecting effect of scrubbing, detergents, and germicides.



What do we do actually in surgery? I think you can see in Figure IV that everybody decides what his penance of scrubbing is for the day (Figure V), and this is it! Operating room personnel go through some single-shot detergent, then go into the operating field and do their job. When they come out of that operation, they simply wash their hands, go through another single-shot detergent, and go into the next operation without any great scrubbing or without any great ado.

This is perfectly safe technic which saves a great deal of time and anguish, once you recognize that you're talking about brush strokes on individual skin, and not time on a clock—not a routine which if followed honestly will leave your skin sore and raw and make it so that you really have a big problem with bacteriology, because in a sore, raw skin the inflammatory response in itself encourages the growth of bacteria.

One kind of skin you have to watch in the operating room is that in which dermatitis is provoked either mechanically by scrubbing or chemically by the alkali earth soaps which are deposited when soap is used. Be certain that a person with this kind of skin scrubs the skin every day, so that there is a minimum contact with the brush. Be certain the brushes are not laden with alkali earth soap from previous users. Be certain that he uses one of the synthetic detergents which do not deposit the alkali earth film of insoluble soaps in the skin to provoke contact dermatitis. About five percent of hospital personnel have this problem.

We have discussed the *in vivo* suppression of skin bacteria as it is applied in practice. We had best review

the evidence that justifies such use (Figure V). The top line depicts cumulatively the number of bacteria removed by mechanical scrubbing with distilled water, the dotted line is mechanical scrubbing with soap, the dashed line is mechanical scrubbing with one of the synthetic detergents. You notice that these latter are more effective. They help solubilize desquamating epithelium and remove more bacteria mechanically than distilled water alone. They also reduce the friction and make scrubbing more comfortable.

The line of crosses represents scrubbing with an active solution of hexachlorophene. The original count is indicated by the large cross. The active chemical was applied for a minute and a half—10 brush strokes—and you see the enormous degree of suppression, from roughly 2,000 organisms down to a paltry 10 or 15 per square centimeter. This illustrates the striking effect that you can get by using the new synthetic detergents.

What should be done about the skin of the operative site? The technic employed differs with the clinical circumstances and the time available. Consider skin preparation for elective surgery. When you are scheduled to remove a meningioma a week from Friday or when you know you are going to do an osteotomy, or perform an elective laparotomy, the patient should be given a small container with detergent containing hexachlorophene when he is booked for hospitalization. He should be told to scrub the operative site twice a day with an ordinary wash cloth, so that hexachlorophene has a chance to be absorbed into the skin and the bacteria suppressed. When he comes to the hospital, his skin bacteria are under control.

This is done by many surgeons, but once the patient is admitted, the hospital forgets to provide him with the detergent, and while he lies around preoperatively, the bacteria merrily grow again. This treatment must be continued in the hospital as well.

In the hospital, these patients continue their washing regime until they are brought to the operating room. When they are anesthetized, a lather is worked up with the same kind of detergent, and is shaved off. The shaving obviously removes hair, and also much of the desquamating epithelium.

The shave should be done immediately before operation, because it is impossible to shave a skin without cutting off many of the little mountain tops that stick up, and an inflammatory response ensues. Wherever you have inflammation, in three or four hours you have bacteria growing, and when the surgeon makes his incision he is cutting through a mass of living organisms which are growing vigorously in an area of decreased resistance. Hence the shave should be done immediately before the incision is made.

This suppression technic is applicable to most of the skin disinfection problems except for patients who enter for what we might call "unplanned operations."

Unplanned operations, like those for acute cholecystitis or acute appendicitis, present a different problem because there has been no opportunity to suppress skin organisms. Hence we rely on detergency and a

single-shot germicide. Here, I think the most effective prep is that of scrubbing the skin with 1:750 aqueous quaternary ammonium compound (a cationic detergent) alternated with 50 percent isopropyl alcohol (an anionic detergent). Scrub with six changes of sponges saturated alternately with each germicide until the skin is a rosy pink, indicating that you have removed most of the desquamating epithelium, and your single-shot germicides have been pushed down into the skin layers where the organisms are found.

Another problem in skin disinfection concerns superficial malignancy. A mechanical scrub such as I have described is too traumatic. Aqueous iodine over a soap lather, or iodine combined with a synthetic detergent, is good in cases of cancer of the breast, cancer of the lip, and other superficial malignancies—cases in which, if you really scrub and do a good job of mechanical removal, you also massage metastatic cells on their way.

There are several other areas in which atraumatic preps are helpful—the axilla, the scrotum, and the vulva, for example. Here suppression technics are very effective if the patient is available for a sufficiently long period of time. Otherwise an atraumatic prep is essential.

Then there is the situation—like the crushed hand, the open fracture—in which you have dirt, grease, and blood. I persist in using a slurry of calcium hypochlorite brushed on with a nylon bristle scrub brush for three minutes. This is shaved off with a sharp razor, taking care to shave away from the wound. The wound and the disinfected skin are rinsed freely with sterile Ringer's or saline solution.

That is as brief a description as I can give of background of skin disinfection, trying to orient the theory into every-day practice and to recommend several technics which you can use. I have tried not to mention names of germicides but rather the names of chemical families and groups. I think you will find in any of these groups or families there are eight or 10 or even 40 or 50 commercial products which qualify. All you have to do is read the labels to discover the active agent in them, and make up your own mind where they fit into the picture.

I think there is room for individual idiosyncrasy in the likes and dislikes of a surgical staff as to whether they prefer a colorless field or one that is stained. However, you never use an alcoholic germicide when you anticipate using a cautery, because the alcohol-saturated drapes give off alcohol vapor which can be ignited by the cautery. Many burns along the side of the flank that are blamed on tincture of iodine are actually thermal burns, resulting when the alcohol vapor under the drapes has caught fire. There is a flash of colorless flame when the cautery is used. You can identify a burn from this source because the nap on the blanket or textile is charred, and the patient has a typical second-degree burn. So, whenever you use the cautery, do not use a flammable solvent for your germicide, or use a flammable germicide.

There are many acceptable technics for skin disinfection all based upon—

(a) Suppression of bacteria

(b) Mechanical scrubbing to keep the skin in good condition

(c) Coupling the shave and the disinfection as closely to the operation as possible

(d) Remembering that whenever you have a respiratory infection, your hands are teeming with organisms which are out of control, and you have no place in the care of the patient. You should become a patient yourself and get your hands safe, rather than spread havoc among people who are asking for help and not for a handicap.

Question and Answer Period

Q. Does the preparation of the skin have anything to do with the formation of keloids?

A. No. Keloid formation is an individualistic response to healing which is characteristic of some individuals. It probably is more characteristic of their response to stress and the general stress reaction than anything else. It is over-response to healing. Some people do not have it every time. As you deplete the stress reaction in second and third operations, for example, the keloids do not form to as great a degree as in the first operation in a series.

Q. An area is painted with dyed Zephiran to delineate it and then scrubbed with Phisohex. Is the Zephiran film destroyed?

A. I think the Zephiran is effectively removed from the area, leaving instead an area in which the skin has adsorbed a bacteriostatic agent—hexachlorophene. I think the correct way to use the combination would be just the reverse of what you propose.

Q. What is the best routine skin prep?

A. There is no "best routine." You have to define your patient's problem. Some of them have elective procedures in which you use suppression. Others are unplanned procedures in which you have to use mechanical means plus the detergency plus germicides. Others are bleeding and traumatized, and you have to depend chiefly on chemical effect—calcium hypochlorite, for example—and you take three minutes of careful scrubbing to really do the job. This is not advantageous.

Q. Do women's faces have dangerous organisms?

A. Most women's faces have been so well cared for that they can be incised without any danger. But never operate on a lady with a runny nose.

Q. How about using tincture of green soap and ether?

A. The green soap is useless. It is a poor detergent; it deposits the alkali earth into the cells. Ether is an explosion hazard which should not be tolerated, and it does nothing for the prep.

District of Columbia and Suburban Area A.O.R.N. Group Elects New Officers for 1955

Officers and new board members of the District of Columbia and suburban area operating room nurses' group are (l. to r.), standing: Mrs. Elizabeth Eberhardt, Vivian Sanderson, and Erline Perkins, members of the board. Seated (l. to r.) are: Mrs. Katherine Gibson, vice president, Captain Kathleen Phillips, president, and Mrs. Gertrude Payne, secretary. Not pictured is the treasurer, First Lieutenant Margaret Gibson.

Hawaii A.O.R.N. Group Meets

Mrs. Rita Gallegos, operating room supervisor, Queen's Hospital, was recently installed as president of the A.O.R.N. group, Oahu, Hawaii, when the members met in Honolulu.

Members and their hospital affiliation are: Alice Hane, Queen's; June Fowler, Queen's; Sue Umoto, Queen's; Peg Neal, Queen's; Mabel Oshiro, Queen's; Barbara Foppiano, Queen's; Myra Ching, St. Francis; Betty Jerabek, St. Francis; Beth Chang, Queen's; Georgia Yuen, Queen's; Virginia Fico, Queen's; Norma Kortum, Kapiolani; Marie Kendricks, Kapiolani; Colleen Smith, Territorial; June Aoki, St. Francis; Lorena Layman, Children's; LaVera Wagner, Children's; Mary Lee, St. Francis; Rita Gallegos, Queen's; Ellen Jane Murakami, Queen's; Margaret Rodearmel, Leahi; Irene Snyder, Children's; Vivian Pereira, Territorial; Edith Yoshihara, Queen's; and Michiyo Fujishige, Queen's.

Fresno A.O.R.N. Holds Organizational Meeting

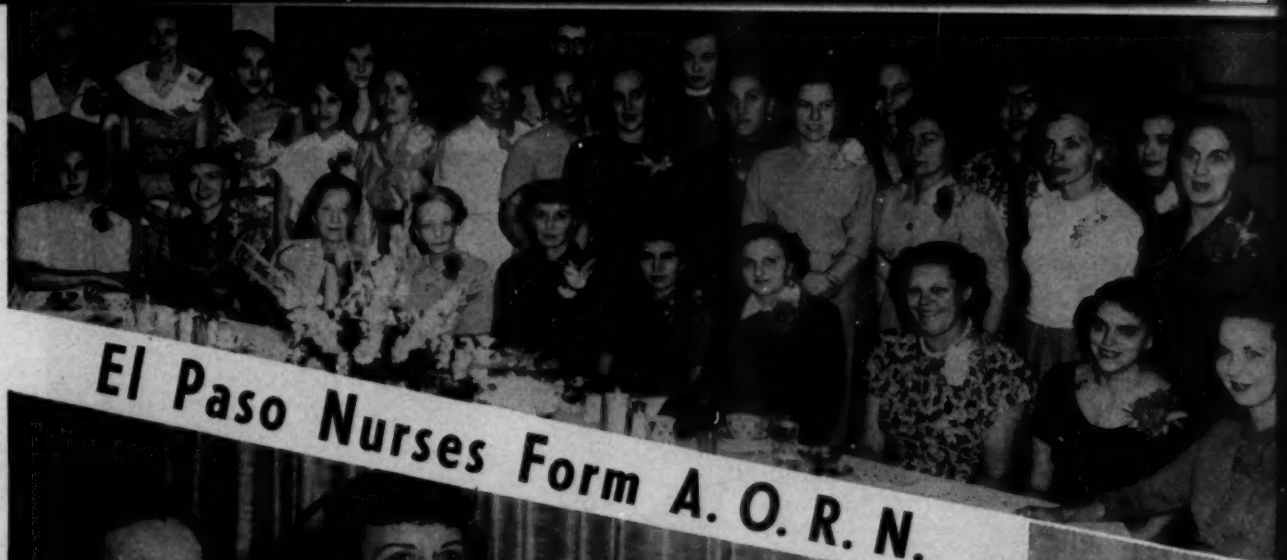
The first official meeting of the Fresno (Calif.) Association of Operating Room Nurses was held a few months ago. Pictured at left are the officers of the new group. Front row, (l. to r.): Miss Mary Sands, Chairman, Fresno Community Hospital; Miss Amanda Laterza, Vice Chairman and Program Chairman, VA hospital; Mrs. Helen Woodward, Secretary and Treasurer, VA hospital. Back row (l. to r.): Miss Ruth Johnson, Chairman of Nominations Committee, Fresno County General Hospital; Mrs. Eula Bryant, Chairman of Membership Committee, Valley Children's Hospital; Mrs. Hazel Lawler, Chairman of Rules and Regulations, Madera County Hospital; Mr. William Manolio, Publicity Chairman, VA hospital.

Panhandle A.O.R.N. Holds Election

Panhandle A.O.R.N. officers, all from Amarillo, Texas, are (l. to r.): Ramona Price, President, St. Anthony Hospital; Pat Jackson, Secretary, Northwest Texas Hospital; Phyllis Cline, Treasurer, Northwest Texas Hospital; Theresa Haley, Program Chairman, VA Hospital.

Members of the recently organized El Paso (Tex.) A.O.R.N. are (top picture) seated, (l. to r.): Connie Gergas and Peggy Vogt, private scrub nurses; Rosamond Poole, ORS, Providence Hospital; Frankie Hunsicker and Carolyn Rodgers, private scrub nurses; Elba Herrera, El Paso General Hospital; Loretta Achen, William Beaumont Army hospital; and Margie Dick, Esperanza V. Valenzuela and Corrine Garven, all of Providence Hospital. Standing: (left to right) Nell Haynes and Melda Dunst, all of Southwestern General; Rosemund Cueto, Josephine Maceyra and Lila Dunnam, all of Hotel Dieu Hospital; Senya Trumble, Providence; Olivia Martinez and Judy Curry, ORS, both of El Paso General; Josephine Y. Gonzales and Esther Seeno, both of Southwestern General; Jane Corbett, private scrub nurse; Dorothea Norman, Virginia Stohner and Betty Lou Tooley, all of Providence; Marjorie Berger, William Beaumont; Josephine Maceyra, Hotel Dieu; Annette Kurtz and Anna Francisco, both of William Beaumont; and Erlinda Martinez, Hotel Dieu Hospital.

Bottom picture: Officers are, (l. to r.): Frankie Hunsiker, treasurer; Carolyn Rodgers, vice president; Rosamond H. Poole, president; Elba Herrera, secretary; and Loretta Achen, program chairman.



El Paso Nurses Form A. O. R. N.

Long Beach Nurses Form A.O.R.N.

Organizational group of the recently formed Long Beach, Calif., Association of Operating Room Nurses are, front row, (l. to r.): B. Asnoux, St. Mary's Hospital; Bernice Ginrich, Hawthorne Community Hospital; Phyllis Jensen, Long Beach Community Hospital; Sally Sills, San Pedro Community Hospital; Marie O'Koren, Seaside Hospital, Long Beach; and Mrs. Ethel West, Methodist Hospital, Los Angeles. Mrs. West, who is president of the Los Angeles A.O.R.N., was the guest speaker at the initial meeting.

Back row: Mrs. Virginia Coulter, Magnolia Hospital, Long Beach; Mrs. H. Anderson, VA Hospital, Long Beach; Dorothy Wright, Hoag Memorial Hospital, Newport Beach; Dolores Wagner, Harriman-Jones Hospital, Long Beach; Betty Parrish, Hoag Memorial Hospital, Newport Beach; Sue Grayson, Harbor General Hospital, Torrance; Gwen Barnett, VA Hospital, Long Beach; Florence T. Lynch, Long Beach General Hospital; and Mrs. Ruth Cooper, St. Mary's Hospital, Long Beach.

Evansville Area Nurses Join A.O.R.N.

● One of the first meetings of the newly organized Evansville (Ind.) Area Association of Operating Room Nurses was held recently at the Gibson General Hospital, Princeton, Ind. Operating Room nursing personnel from 14 hospitals in the area comprise the membership.

Some of the members of the new group are (standing, rear row, l. to r.): Miss McEvilly; Mrs. E. Kerney, in charge of membership; Mrs. Gladys Bray, president. (Seated, front row, l. to r.): Miss M. Webber; Mrs. D. Brunner, treasurer; Mrs. M. Anderson; Miss K. Seitz; Mrs. S. Silkey, and Mrs. V. Flowers. Officers not shown are Mrs. Juanita Wallace, vice-president, and Mrs. Ruth Leeds, secretary.

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